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AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

ISSUED WEEKLY BY THE AMERICAN MACHINIST PRESS,

Vol. 22. 218 WILLIAM STREET, NEW YORK. No. 3.

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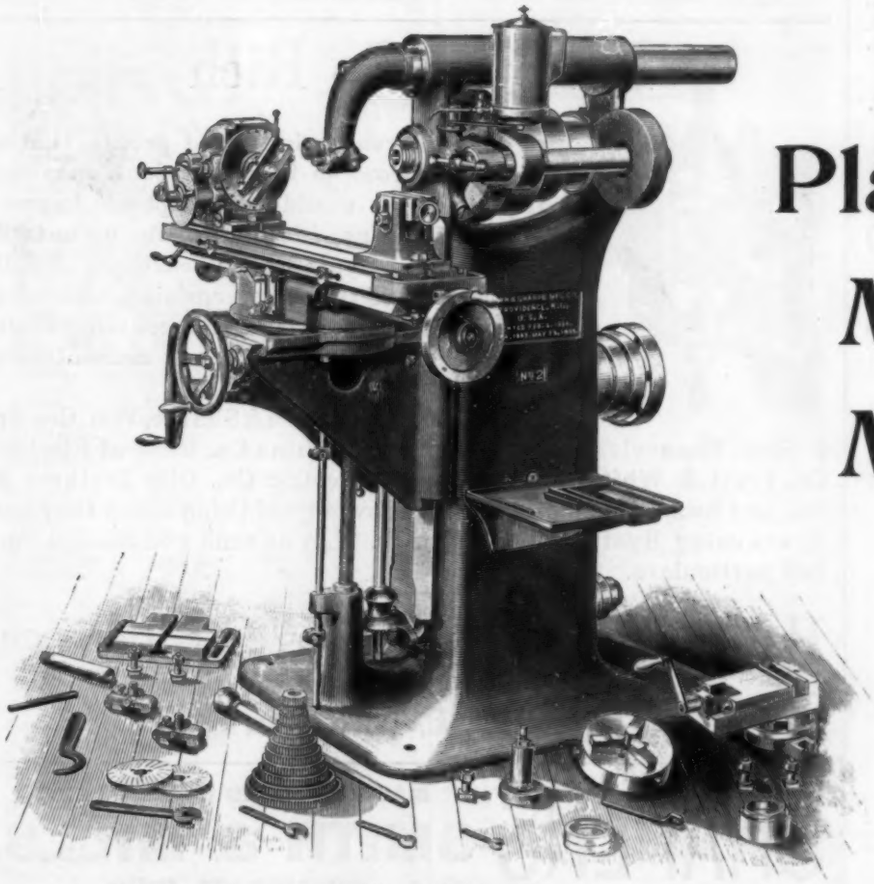
BROWN & SHARPE MFG. CO.,

Machinery and Tools,
Providence, R. I., U. S. A.

Universal Milling Machines.



Plain Milling Machines.

REPRESENTATIVES:

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Buck & Hickman, London.

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GERMANY:
Gustav Diechman & Sohn, Berlin.

Our No. 2 Universal.

Catalog Mailed to any address upon application.

Heavy Floor Grinder.

▲▲▲

This machine is unusually heavy and substantial, and is made in the same thorough manner as our other machines, with the intention that it shall be the best of its class. The boxes are unusually long and are self-oiling and babbitted. The flanges are large, and the loose flanges have spherical seats for the bases of the nuts, which are case-hardened.

The machine takes wheels up to 36 inches diameter, 5 inches face, with 2⅛ inch hole.

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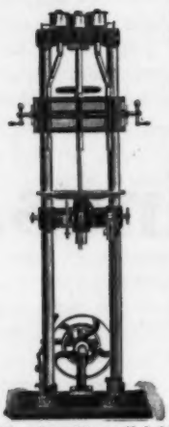
Founders and Machinists,

PROVIDENCE, R. I.



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Adjustable to drill holes from 1 inch to 6 inches apart. Extreme range, 12 inches. Three sizes of drills can be used simultaneously. Center spindle stationary. Outside spindles can be adjusted independently. Also 2-spindle drill, exactly similar, but without the central spindle. Power or hand feed. Very quick and thoroughly efficient.

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Manning, Maxwell & Moore, New York.
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Dust-Proof, Self-Oiling Bearings.
Bronze-Bushed, Self-Oiling Loose Pulley.

This machine may be belted from above or below. Dust and lint cannot be carried into it by the belt. Weight 400 lbs. net.

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Are Your Profits Going Up in Smoke,

in lost time and slow fires that are the regular accompaniments of the back-number coal or coke furnaces? If they are, don't you think it's about time to call a halt—to throw out the old time and labor wasters, and put in the kind that makes every minute count for you—the American Gas Furnace Co.'s Gas Furnaces?

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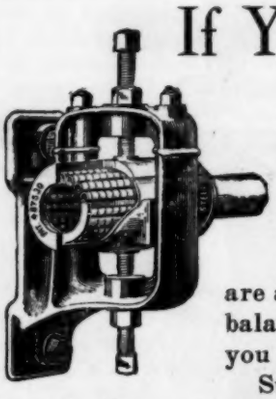
American Gas Furnace Co., 23 John St., New York.

Chas. Churchill & Co., London and Birmingham,

If You're So Rich



or so indifferent to increased profits, that a saving of from 30 to 50 per cent. in your friction losses would not tempt you to consider the means, it's useless for us to talk to you about Hyatt Roller Bearings. But if you're one of those enterprising men who are always looking for ways of increasing their balance at the bank, we're sure we can interest you in them.

Such concerns as Brown & Sharpe, Wm. Cramp & Sons, Pennsylvania R. R., Hendey Machine Co., General Electric Co., Pratt & Whitney Co., Sprague Electric Co., Otis Brothers & Co., and hundreds of others who know a good thing when they see it, are using Hyatt Roller Bearings. Let us send you the list and full particulars.

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CINCINNATI, OHIO, U. S. A.

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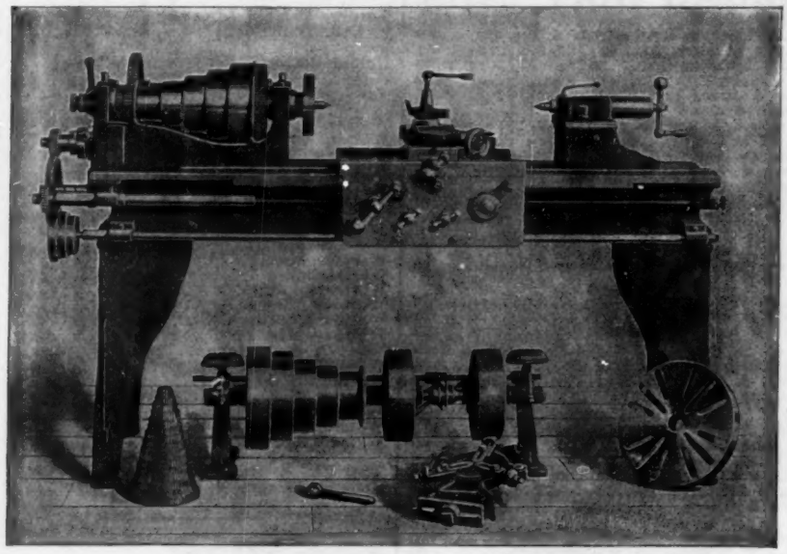
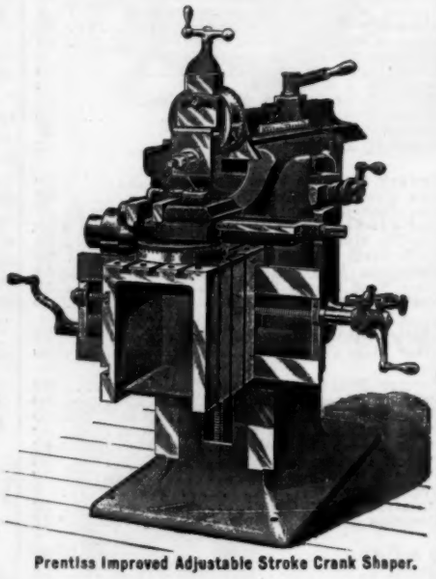


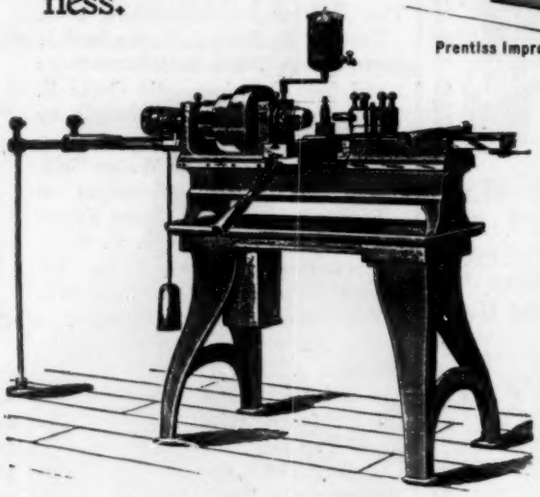
13 Inch Prentiss Special Lathe, especially designed for export.

'Tisn't What We Say,

altogether, that influences so many good shops to replace other machines with ours; it's what pleased patrons say, that does the business.



Prentiss Improved Adjustable Stroke Crank Shaper.



Prentiss Wire Feed Screw Machine.

Let us tell you who some of them are. . . .

You can hardly afford to overlook the Prentiss products, whether you want to buy a complete outfit or only a single machine.

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SPECIAL BARGAINS IN Second-Hand Machinery

LATHES.

84 x 20 Cleveland, triple geared.
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26-50 x 26 Gap.
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12 x 5 Prentice Bros., R. & F. and chuck.
12 x 5 Young, R. & F. and chuck.
10 x 5 Reed, R. & F. and chuck.
15 x 5 ft. 6 in. Amer. T. & Mch. Co., sq. arbor fox, fine.
12 x 5 P. & W. speed and chuck.
50, 33 and 30 Putnam pulley.
40 in. pulley. 2 heads.
26 and 28 in. Stevens pulley.

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16 ft. Hilles & Jones plate.
66 in. x 60 in. x 16 ft. Waterbury.
36 in. x 36 in. x 10 ft. Putnam.
36 in. x 32 in. x 10 ft. New Haven.
30 in. x 30 in. x 6 ft. planer.
26 in. x 26 in. x 8 ft. Putnam, fine.
26 in. x 26 in. x 8 ft. Lathe & Morse.
25 in. x 25 in. x 6 ft. Sellers.
24 in. x 24 in. x 8 ft. P. & W.
24 in. x 24 in. x 5 ft. Powell with chuck.
20 in. x 20 in. x 5 ft. Newton.
18 in. x 16 in. x 4 ft. planer.
16 in. x 16 in. x 12 ft. Whitcomb, crank.

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48 in. Betts radial, good as new.
40 in. Betts radial, good as new.
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2-24 in. Bickford, plain, sliding head.
20 in. Prentice Bros. W. & F. and chuck.
2-20 in. plain, with chuck.
4 spindle Ames gang, with chuck.
2-4 spindle States sens., with chucks.
3 spindle Barnes, 22 in. swing.
2 spindle Sigourney, with chuck.
2 spindle Novelty sens., fine.
2 1 spindle Sigourney, with chucks.
2 1 spindle Slates sens. and chucks.

MILLING MACHINES.

No. 3 Cinn. Univ.
No. 1 Cinn. Univ.
No. 1 B. & S. Univ.
No. 15 Brainard Univ.
No. 2 Kempsmith, plain.
No. 2 Newton power.
3-Cook Lin. Pat. B. G.
3-Ames Lin. Pat. B. G.
P. & W. Lin. Pat. B. G.
No. 1 P. & W. hand.
No. 1 Garvin hand.

SCREW MACHINES.

No. 3 B. & S. W. F., P. F.
No. 2 1-2 P. & W. drawin chuck.
No. 3 Windsor plain, 2 chucks.
No. 2 Prentiss plain, with set of tools..
2 No. 1 P. & W., W. F., fine.
Cleveland Auto.

MISCELLANEOUS.

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Cincinnati cutter grinder.
P. & W. cutter grinder.
No. 3 Garvin cutter grinder.
Putnam cutter grinder.
2 spindle P. & W. centering machine.
2 spindle Whiton centering machine.
2-2 spindle Brown centering machines.
1 spindle Garvin profiler.
4 spindle Colt gun stock profiler.
2 in. Bement bolt cutter.
1 1-2 Merriman bolt cutter.
62 in. Bement boring mill.
48 in. Bickford boring mill.
7 ft. Newark horiz. boring machine, 3 7-8 in. bars.
11 in. Putnam slotter.
13 in. Putnam slotter.
33 in. N. Y. Steam Eng. car wheel borer.
1-4 in. style B Adt. riveter and C's.
Adt. wire straightening machine.
Comb. punch and shear.
600 lb. Bement steam hammer.
7 Higley cold sawing machines.

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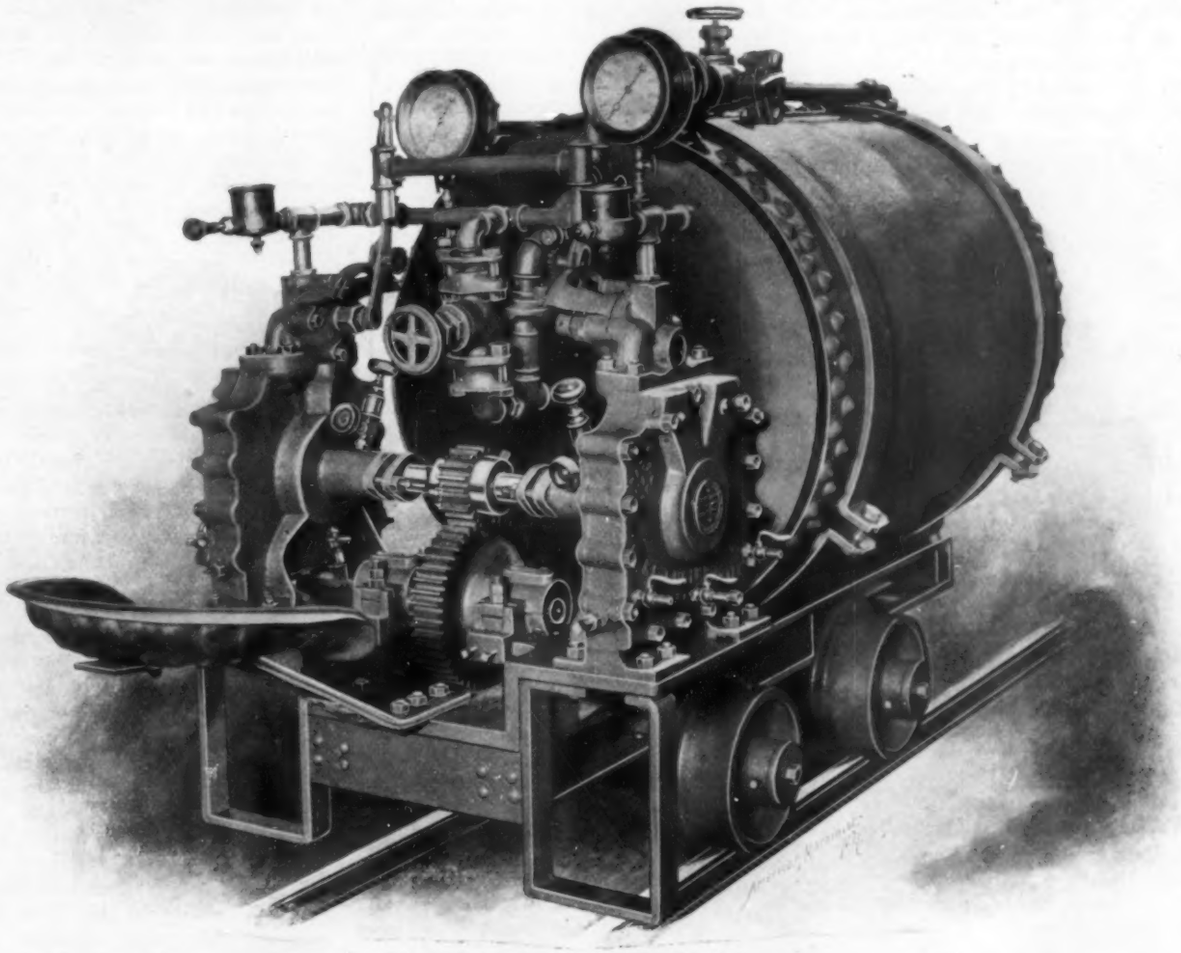
AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION

VOLUME 22 NEW YORK, THURSDAY, JANUARY 19, 1899 NUMBER 3

A Narrow-Gage Compressed Air Locomotive.

The half-tone herewith shows a small compressed-air locomotive designed by Mr. E. A. Rix, and built by the Rix Engineering & Supply Company, of San Francisco, and now in constant use on the 2,000-foot level of the Empire Mine, Grass Valley, Cal. The gage of the track is 18 inches, and the wheel base is 20 inches. The receiver on the motor is 35 inches diameter and 54 inches long. A trailer is used in connection with the locomotive, carrying another receiver 35 inches diameter and 60 inches long. The air storage is thus divided up on account of the sharp turns in the track, some of which have a radius of not more than 10 feet. The pressure carried is from 375 to 425 pounds. Two 4-horse-power "Dake," or rectangular piston engines are connected, one to each end of the upper shaft, and a pinion on this shaft meshes into the large gear below. The engines, which are, of course, reversible, have a speed of 500 to 600 rotations per minute. The connection to the axles, which is by cut sprockets and chains not visible, makes the motion of the engine shaft to the axle four to one. Every valve, cock and lever is easily accessible to the driver from his seat. The two rectangular straps hanging down near the track are for the driver's feet.



A NARROW GAGE COMPRESSED AIR LOCOMOTIVE.

The motor has a run of half a mile into the heading and back again to the shaft, making a total run of a mile. It hauls five mining cars, each carrying one ton of ore, the cars weighing about 1,000 pounds each, making a total load of 7½ tons. The track is not only very crooked, but also has considerable grade, in some places at the curves, and is a very disadvantageous one upon which to operate a motor economically; still it has reduced the cost of haulage from about 25 cents per ton down to 6 cents. The weight of the motor is 3,000 pounds.

This is rather a prosaic-looking machine, and the man who occupies the mower seat in the rear of it would hardly be likely to be referred to as "The bold engineer with his eagle eye on the rail," but it takes the place of the humble mule and is better for its purpose.

Cutting Mica and Fiber.

BY W. A. WARMAN.

Doubtless many readers of the "American Machinist" have had the pleasure of meeting "Micher," as one of my boys puts it, in a business way. As to its influence

on a diemaker's chances for a harp and a crown probably the less said the better. To have to cut mica into shapes with dies is usually sure to provoke slight ruptures of the third commandment.

I have tried various sorts of dies with results also of various sorts. The first thing that suggests itself when a job on such material comes up is the simple and familiar form of punch and die, pushing the work through. It don't work. It will start off all right, but soon the sharp edges of the punch and die are gone, and your blank begins to crack around the edges and to split up into thin pieces. Little flakes are carried down between the punch and die, and they do grind out a die "most amazin." The split pieces will stick to the bottom of the punch, especially if you have a leader on it, and then, if you do not watch close, you will have a cutting edge of mica making a bad job worse. Then we try shearing the punch, and then the die, which makes matters worse and worse.

We are now using compound dies with satisfactory results. We make our dies without clearance and in cutting mica use turpentine as a lubricant. Owing to the straight-sided dies and the facts that it is not necessary to have the punch enter the die more than 1-64 inch, and that there is no cracking or crumbling of the stock, the grinding and cutting of punch and die are reduced to the minimum.

We have discarded rubber for springs in actuating the strippers, and use properly proportioned steel springs, tempered. We find the steel springs much more satisfactory and enduring.

I cannot help drifting a little, right here, into dies. Perhaps I am a crank on the subject, for when a new piece comes up to be made the president generally asks "How will you make that? Stamp it?" I am sure that in most shops the virtues of the compound die are by no means appreciated. The difference in cost is not nearly so great as most people imagine, and is made up in short order in the saving in operations and in stock. I know of shops where the items of flatting and burring blanks amount to more than the cost of stamping. In the instance of the armature disk blank shown, of stock .015 inch to .016 inch thick and dead soft, the cost is not more than half what it was by the other method of pushing the blank through.

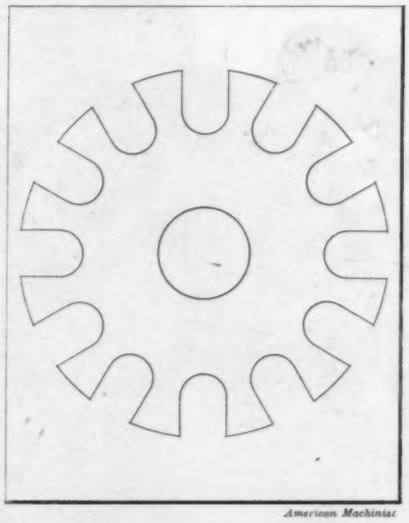
With the latter we had to flat the blank. It is impossible to flat them without stretching some more than others. This made it necessary to turn the finished core outside and file the slots. Turning and filing "bridges" the disks, a feature especially undesirable in armatures.

With the disk from the compound die we have no flatting, no burring, no turning, no filing, no "bridging." A compound die is more easily kept up, makes all blanks exactly alike, makes light scraps, in fact is a "beaut." I know in most cases the "office" thinks a die is a die, and if one die costs more than another die, the die that costs the most costs too much.

But to return to the subject, I find that after trying all other forms, knife-edged dies included, the results on fiber are best with the compound die, cutting the fiber dry.

In cutting the mica we put a package into a pan of turpentine and use the sheets out of the pan. I have no explanation to offer as to the why of the turpentine. We just happened to strike it after trying everything else we could think of.

[Accompanying this article were a number of clean, sharp samples of punchings of disks, of the size and shape shown in the cut, in mica, vulcanized fiber and thin steel. Those of mica and of the fiber were not detached, but were easily detachable, almost by a touch, from the sheets from which they were punched.



American Machinist

The punching is perfect, although, as described in the article, the punch after contact with the sheet had only traveled 1-64 inch or so farther, and had not gone through the sheet. It does not seem to be possible to show the samples as clearly as we would wish, so it is perhaps best not to attempt it.—Ed.]

For a National Department of Commerce and Industries.

For some time past the merchants and manufacturers of the United States have felt that there was need of a new executive department in the Government devoted to commerce and industries, with a cabinet officer at its head. In view of the extended foreign relations opening up before us, the creation of such a department seems now more important than ever. The matter of extending our foreign markets has become one of great and growing importance, and there can be little question of the advantage such a department could afford to our merchants and manufacturers. What is now being done by our consuls in furnishing reports of the needs of foreign markets and the evident advantage to our exporters which this information is now affording, shows that a bureau devoted to the interest of internal and foreign commerce would prove of the utmost advantage.

No more important or more interesting legislation will come before the present Congress than that bearing upon the creation of a Department of Commerce and Industries. During the last session Senator Frye introduced a bill to create such a department. It was referred to the Committee on Commerce for action, but was never reported. The question is being agitated again, and there is every reason to believe that the desired end will be achieved at no late date. Under the terms of the Frye bill, there shall be at the seat of Government an executive department to be known as the Department of Commerce and Industries, and a secretary of the same, who shall have a seat in the Cabinet. This new department shall have jurisdiction over the foreign and internal commerce of the United States, except in so far as relates to the collection of the revenue and the administration of the customs and internal revenue laws; it shall also have jurisdiction over all matters relating to the manufacturing interests of the United States, including the extension of foreign markets for the same, and the increase of trade and trade facilities with foreign countries.

This question is one that should interest manufacturers in every branch of industry, especially at this time of strenuous effort on the part of American manufacturers to build up markets for the products in foreign countries. The importance of disseminating knowledge of foreign trade requirements has been recognized by the governments of the United Kingdom, Germany, France and other nations, to the extent of gathering information of such requirements for the instruction and profit of their respective manufacturing interests, and thus to lead to more extended trade. This systematic work on the part of other nations makes it eminently fitting that the Government of the United States shall assist and encourage any work of similar scope and reliability tending toward the better equipment and instruction of our producing and manufacturing interests. This will be the chief function of the proposed department, and the pending measure should have the hearty support and encouragement of every manufacturer and commercial body.

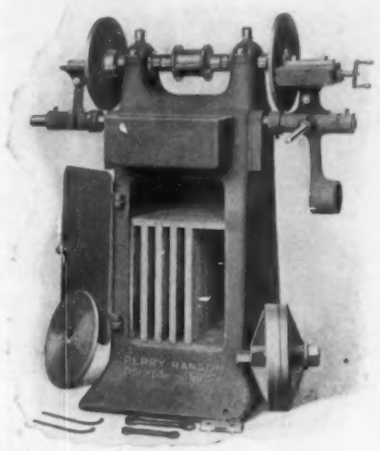
A. F. Tennille.

Washington, D. C., Jan. 3.

Improved Disk Grinding Machine.

We illustrate herewith an improved disk grinding machine which uses instead of emery wheels disks of cast iron, to the faces of which are cemented emery paper

or cloth, thus making a true and perfectly balanced wheel which can be and is run at very high speed. The work is applied to the wheels either by hand or by means of suitable fixtures, and these are swung upon the studs shown to give them the required traversing motion across the face of the disk.



IMPROVED DISK GRINDER.

At the right hand side of the machine is shown a small slide having a screw with graduations reading to a thousandth of an inch, by means of which the work can be advanced to the wheel as the grinding proceeds, and by this means any required number of pieces may be ground to precisely the same dimensions. Both the rests can also be set at any angle desired up to 30 degrees.

The faces of the disks are made smooth, that is without grooves, and made in this way they are found to cut very freely and rapidly. The machine is made by Perry Ransom, Oshkosh, Wis.

Lettering Drawings and Tracings With Rubber Stamps.

A correspondent referring to the communication of William O. Webber, printed in our issue of December 1, says he has been unable to get an ink which will dry within a reasonable time on tracing cloth, stick to it well and be sufficiently opaque for blue-prints, and he asks for further particulars.

Replying to the inquiry Mr. Webber says:

"We did this work very successfully by using the ordinary stick india ink of good quality rubbed very thick and then placed on two pads which were rubbed together until the mass of ink was quite dry and sticky. This would then print very well indeed on both drawings and tracings. I enclose you a blue-print of a stamp made in this way, with the rubber stamp, however, in rather poor condition. There is now, however, an 'excelsior opaque quick-drying' ink which will work all right if treated in the same way, that is, rubbed between two pads until it becomes 'tacky.' I know that this will work all right on tracing cloth and tracing paper because that was practically all we used at Erie. I, however, strongly recommend the use of bond paper for all drawings, as it does away with the necessity of making tracings, and any opaque stamping ink will work perfectly well on bond paper."

Special Operations in a Large Electrical Works.

Many new mechanical products involve new methods of production and enlarged development of old methods to an extent which untimately has an important influence on machine tool practice in other industries, and such products often become quite as interesting to the mechanic on account of the methods followed in making them as on account of their own intrinsic interest. The manufacture of such products starts, as a matter of course, with the machine tools in common use; but if the products reach large commercial importance, they soon lead to the design of tools which are highly special in character and give a distinctive character to the works where they are used. An excellent illustration of this tendency in small work is bicycle manufacture, which has developed methods of production which were used but little or not at all before the beginning of the "bicycle era," but many of which are now applied to other lines of work with great advantage. In heavy work a similar development has taken place in connection with the manufacture of electrical machinery, and the accompanying illustrations of a few of the methods followed at the works of the Westinghouse Electric & Manufacturing Company will be noted with interest by our readers.

Figs. 1 and 2 show a machine for boring dynamo frames, of which it would be hard to find a mate in any other industry, or indeed a call for it. The pictures are almost self-explanatory, but it may be noted that the driving is by a cone pulley below the floor, which, through the vertical splined shaft with bevel, worm, and spur gears, drives the boring bar. This bar, it will also be noted, may be located at any distance above the floor, the vertical shaft providing for this movement without disturbance of the connecting gearing. The magnitude of the work will be apparent from the workman alongside. The ma-

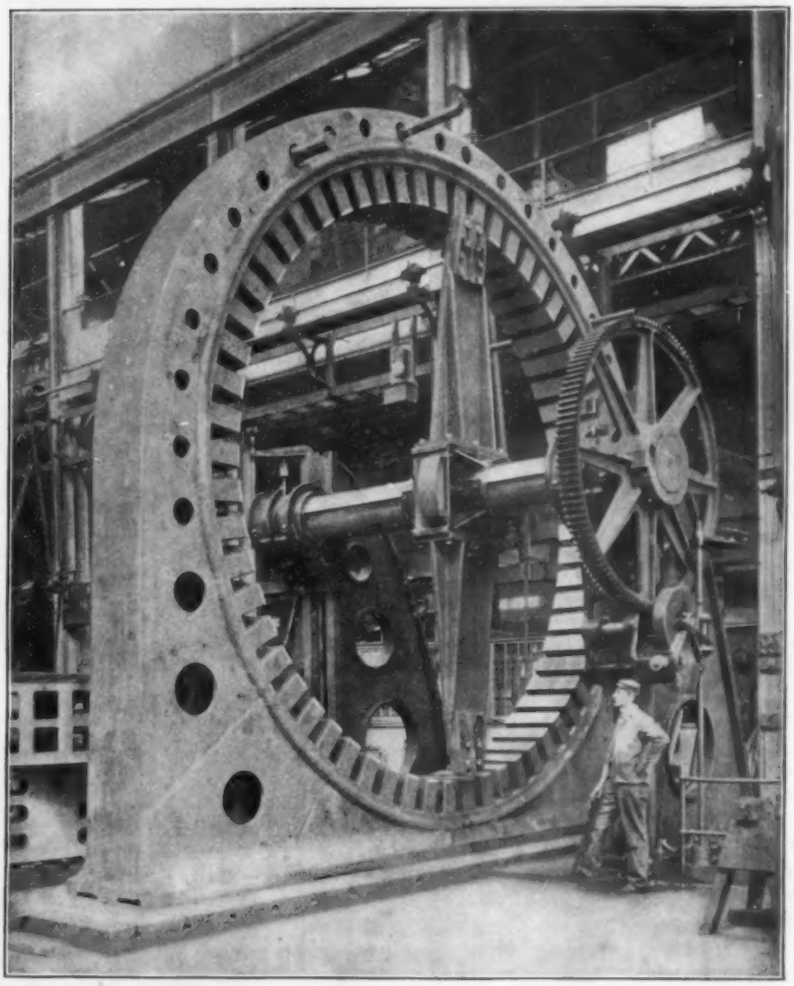


FIG. 1. BORING DYNAMO FRAMES.

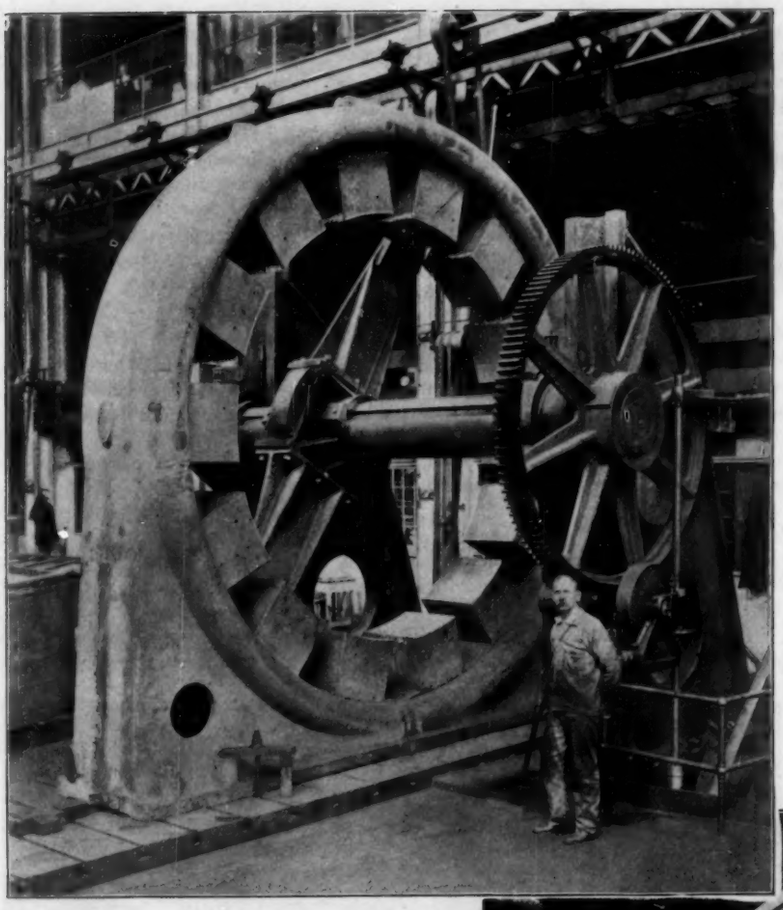


FIG. 2. BORING BRUSH-HOLDER SEATS.

chine is adapted to various sizes of work through the interchangeable ribbed arms, the casting surrounding the bar and the tool holders at the ends of the arms being used with various lengths of arms. A turned segment will be seen on the side of the center casting, the purpose of which is to assist in gaging the work. This segment and its mate opposite are turned to a true diameter of 48 inches, and they serve as an abutment for one end of a gage for the size of the bore, and thus obviate the disadvantage of having the bar in the way of a long gage, and moreover enable short and convenient gages to be used in place of long and inconvenient ones. In the case of Fig. 2, the work being done is the boring of the brush holder seat.

Fig. 3 shows a special machine for milling interior slots of the ring frames. Below will be seen a table which may be revolved by the worm gear and ratchet lever, and then be fixed in position by the binding straps, of which one is in sight. On this plate and operated by an electric motor is a special milling machine having a horizontal spindle, the cutter being on the end farthest from the observer. The feed gear operates the spindle vertically upon the post, the effect being obviously to mill longitudinal slots in the interior of the ring. For positioning the work, the machine is removed and a stiff mandrel is inserted in a socket in the center of the table, this positioning being obviously assisted in large degree by the T-slotted floor plate on which the entire machine stands. The slots require to be indexed with a high degree of accuracy, and to accomplish this an unusual method is employed. Over the worm box at the base will be seen a stepped plate, which is curved to follow the revolving table. The steps are beveled on the top edge, and each step carries a fine hair line which matches corresponding lines on the table. The table is provided with several sets of divisions to suit different pieces of work, each set being located vertically to match one of the steps, so as to avoid confusion between the different divided circles. The revolving of the plate is by the worm and ratchet lever, the lines being matched under a magnifying glass. Since no gearing whatever is included in the indexing system, it follows that with accurately divided circles a high degree of accuracy is attainable in the work. The large brush holder ring in the background was present by accident when the photograph was taken, and has nothing to do with the work.

Fig. 4 shows a machine suitable for a class of work similar to that shown in Fig. 3, but on the external instead of the

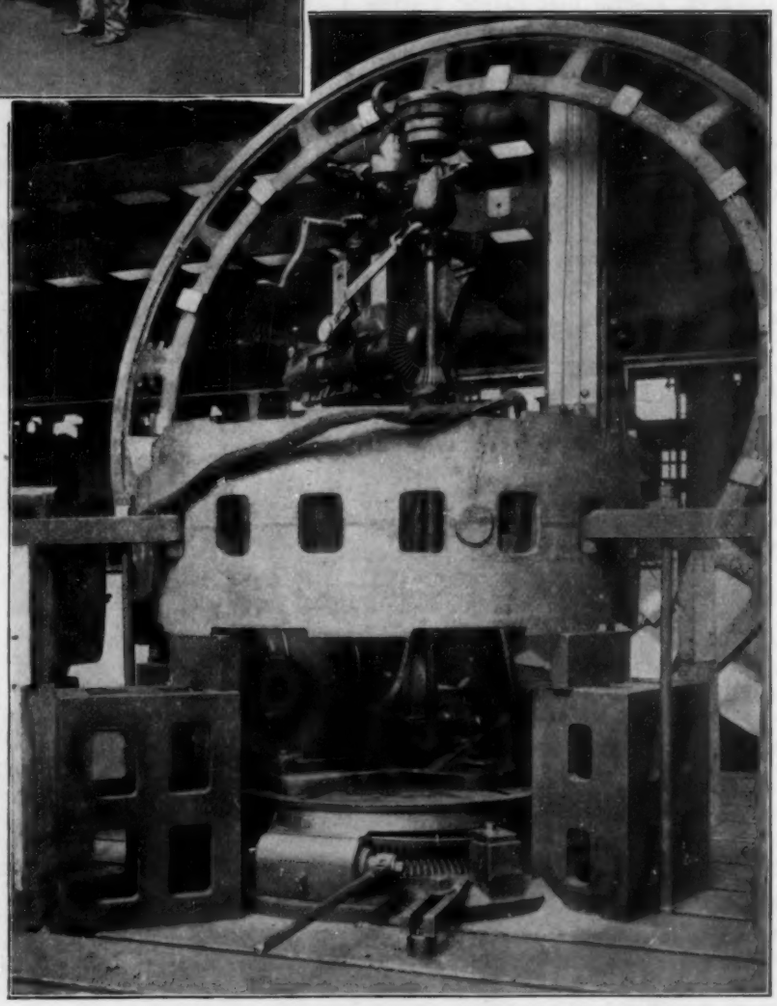
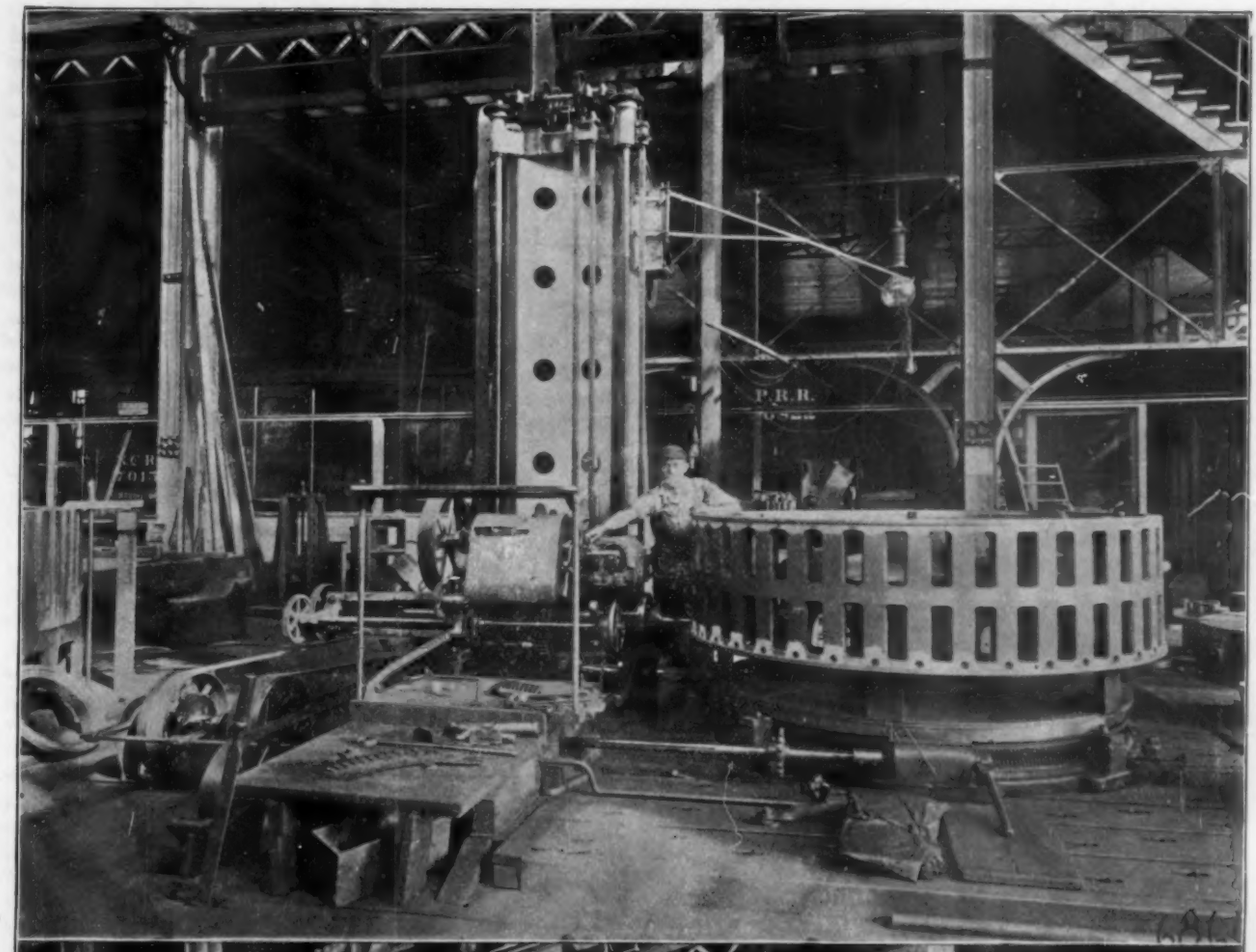


FIG. 3. INTERIOR INDEX MILLING MACHINE.



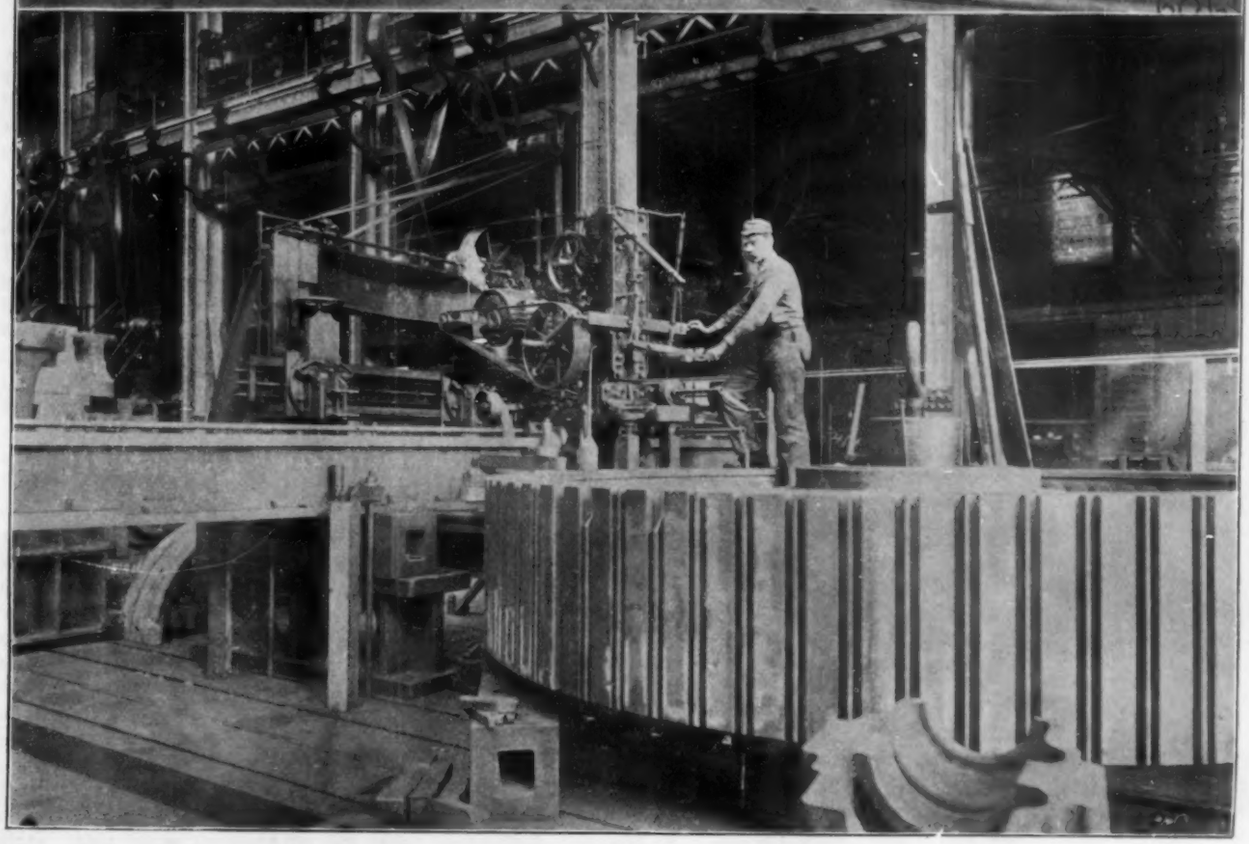
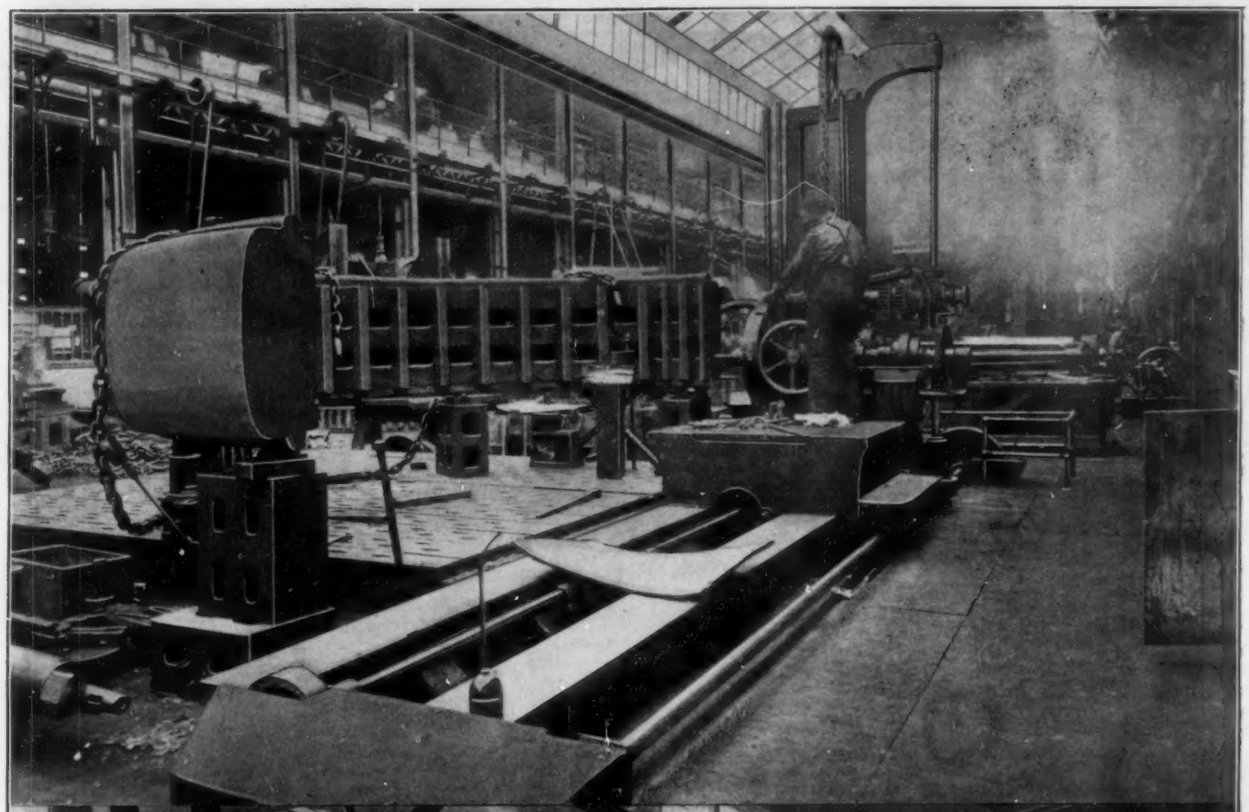


FIG. 4. EXTERIOR INDEX MILLING AND DRILLING MACHINE. FIG. 5. HEAVY MORTON PORTABLE SLOTTING MACHIN



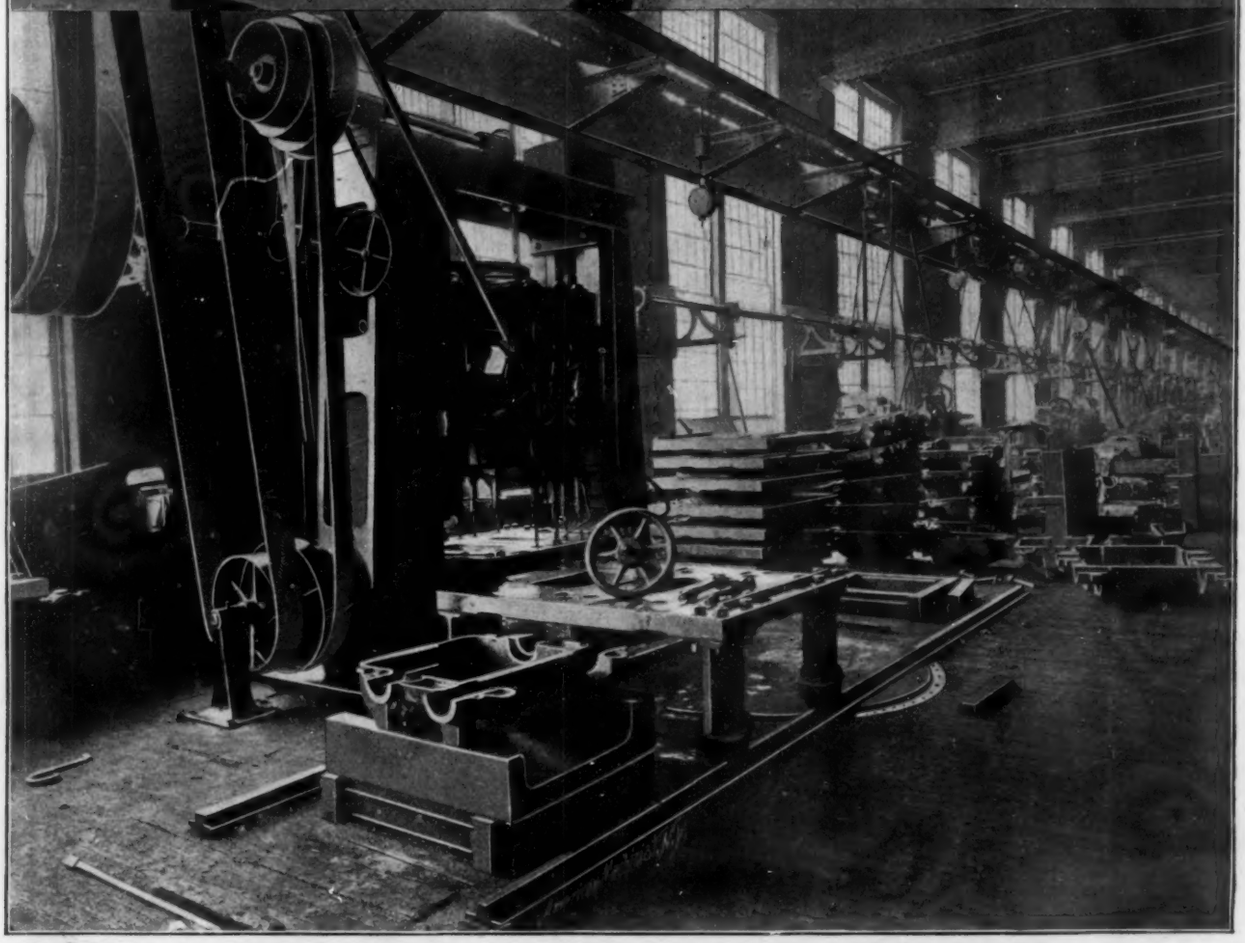


FIG. 6. HORIZONTAL MILLING AND DRILLING MACHINE. FIG. 7. A HEAVY PIECE OF JIGGING.

internal surface of the ring. As shown in the photograph the machine is drilling holes only, but it is also employed for milling slots. The same arrangement for indexing as in Fig. 3 will be seen, with the addition of power mechanism, which is used on account of the greater magnitude of the work handled on this machine, and especially in setting the work. The fine adjustment for indexing is made by hand, as in Fig. 3. The magnifying glass will be seen in position in Fig. 4, an adjustable mounting being provided for it, so that when once set and focused for any step of the index it may be left and consulted as desired. A button for mounting a similar glass will be seen in front of the worm box of Fig. 3.

Fig. 5 shows a multiple electrically-driven Morton slotter roughing out slots on a large armature spider. The work is turned in front of the machine to bring it in position for the varous slots. This being a roughing operation, no great accuracy of the indexing is needed or attempted. The planing machine housing in the rear has no connection with the work, the slotting machine being supported on the heavy horizontal iron girder which is mounted on blocking, the T-slotted floor plate again greatly facilitating the operations. Adjustable stop pieces will be seen between the machine and the work, to take the strain of the cut, which is made on the pulling stroke. This rig fairly hoes off the metal, and in the Westinghouse shops the machine is known as "Jack the Ripper."

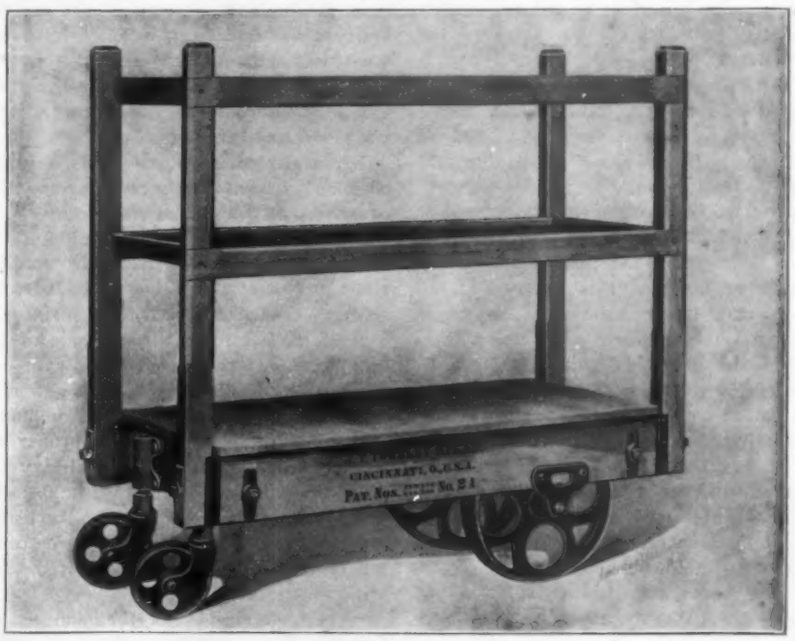
Fig. 6 is self-explanatory, and serves again to show the magnitude of the operations. The holes made are obviously parallel, and we believe the machine is also used to mill the faces of the joint at the same setting.

Fig. 7 shows a piece of jig work that is jig work. The work to be done is the drilling of a steel car motor jacket or frame, one of which is seen in the foreground on blocking. The jig is just beyond the motor frame, and on account of the weight of jig and work the former is mounted on wheels and a track and turn-table are provided to facilitate handling and bring the work to position under the press. In use the jig is wheeled over the work when the latter is bolted to the former. The two are then pushed on the turn-table, turned around and pushed under the drill press, which has eight spindles for drilling as many holes at once. Two jigs are provided so that one can be loaded while the other is under the machine. The track and turn-table shown enable the work to be received at one side of the machine and delivered at the other, the arrangement as a whole being one of the most advanced heavy drilling outfits that we have seen. A pile of jigs for different motors will be seen just beyond the machine, these being mounted on the legs and wheels as required.

An Assembling Truck.

At the shops of the Cincinnati Milling Machine Company and other places in Cincinnati we have noticed in use a form of assembling truck, which is shown in the accompanying engraving and which we are satisfied conduces very much to the economical producion of some, if not all, kinds of machinery.

In the shops mentioned above their method of using it is to run one of these trucks into the stock room and to place upon its various shelves all the parts required to assemble a milling machine. This work is attended to by the man in charge of the stock room, and the truck is then drawn to the assembling floor and placed alongside the column or frame of the machine, and the erector thus has at hand every part required in the most convenient location and without being obliged to use his bench or the floor for storage purposes.



AN ASSEMBLING TRUCK.

The truck is made of hardwood and with one platform only, or with as many shelves as may be desired, and the wheels are so arranged as to prevent any tilting of the truck which might throw things off from it; yet, one pair of wheels being arranged similar to furniture castors, enables it to be turned in a very small space. It is made by the John T. Towsley Manufacturing Company, Cincinnati, O.

The Ethics of Employment in the Modern Factory.

At the last meeting of the Church Association for the Advancement of the Interests of Labor, held in this city, William C. Redfield, treasurer of J. H. Williams & Co., manufacturers of drop forgings in Brooklyn, read a paper on "The Ethics of Employment," which was followed with close attention by the many persons present. Mr. Redfield said:

"The former close relation between master and craftsman, when employer and employed lived under one roof and shared one common toil, has passed away; a different order of ability has taken the place once held by the master workman. The old régime of personal touch between workmen and masters is forever gone, and leadership which must of necessity be somewhat impersonal has taken its place. The relations between employer and employee will not be always as they are; they are not now what they were in the last generation. The spirit of change is in them, and it is important that their movement be so guided as to lead not only to public comfort and material wealth, but, it may be, to the development of happier lives and better men.

"Grave danger in dealing with this problem lies in seeing partially, in knowing but one side, in observing but half the picture, and in reflecting not at all. The artisans of this country, the men and women who, with their hands, labor for a daily wage, are worthy on their merits of respect and sympathy. They are no lower, discontented class, continually clamoring for more than is their share. They earn their bread, giving for it a full equivalent of toil, and on the average they spend their earnings as carefully as any. They have a wholesome discontent with narrow conditions, and look forward to a time of greater abundance, higher wages, and shorter hours. They rightly aim to provide for their children things

better than their father had. They love recreation like other men, and claim the right to time for it, as they ought.

"It will not be claimed in what follows that the modern factory is a benevolent institution, much less a kindergarten. We shall, however, frankly face the question whether it is not a place in which men can do right.

"Does the pay roll end all? If not, what does the employer owe the employee? Clearly the lot of the employer and employee is in many points common; both live from one source; they are prone to look upon their relations from opposing sides; the employer is tempted to regard the man as a machine, to reckon upon his productiveness as he does on that of a mechanism. On the other side the employee is tempted to regard the employer as a bank from which to draw the largest possible weekly sum; as one whose interest is not his own; to get his weekly wage with the least expenditure of toil and energy.

"Does the pay roll end all? Is a full equivalent given and taken when Saturday comes and each man goes homeward with his little envelope containing the week's labor cashed at market rates? Having worked well sixty hours, less or more, and having received the agreed sum, is all done for the workman that should be done, if this alone is done? There is a factory, it is said, in which once the superintendent instructed a foreman to hang up his sympathy when he entered the works on the same nail he did his hat and coat. If in addition to this sympathy, the superintendent had hung up his brains, he might answer our question affirmatively, perhaps asking in addition, 'What more would you have?' Yet the only truthful answer is no. The proper relation between the two commences here; and the end is not yet. What does the employer owe the employee? This is, of course, apart from the question of wages—we concede that he owes him the market rate of wages. He really owes him wages based upon the productiveness of his labor, and if, by reason of superior intelligence and industry, he produces more, there is due to him in return a corresponding increase. Before, however, we answer the question, let us for a few moments consider this matter of the pay roll. It is sometimes broadly stated that low wages means low cost of labor, that a certain man produces goods cheaply because he has cheap labor. But this ignores a great element in production, which is not how much per day is paid, but how much is produced for the amount paid. It is not the rate of wages that governs the cost of production, but chiefly the rate of production. And if wages be low and production slow, the labor cost will be high. It is coming to be recognized that high wages, combined with intelligence and perfect apparatus, mean low labor cost per unit produced. Workmen gain large earnings by their ability to produce more. This gain in efficiency is had in proportion as they are given perfected mechanism to operate and are free to develop their energy and capacity in its use. It is the efficiency of labor that counts. When dull times overtake the manufacturer he does not first lay aside his higher paid men, but ordinarily the cheaper ones, because the better paid men are the more economical.

"The advocacy of a wiser method of economizing in manufacturing than reducing wages, forces one urging these views to suggest what methods should be used before what we deem the costly and injurious course of wage reduction be taken. The lines of wise economy in production vary with every class of business, and in each class with locality and individual conditions, but it may not be out of place, as indicating the wide range such economies may take, to mention some of the better general methods adopted by many trained manufacturers. To the query, therefore, as to what should be the prior and major economies, the following partial reply may be given:

"Are the officials of the business efficient for what they receive, or are they ornamental officers, drawing salaries not earned, and which are a tax upon the business, in addition to their possible share, as owners, in the profits? Is the selling department efficient? Is the highest market found for the sale of the output, and if prices fall sharply in one market, is another sought, or a new one, if possible, created? Are costs of manufacture accurately kept, with proper allowance for the unseen but heavy incidental expenses of interest, taxes, depreciation, superintendence, advertising, traveling, etc.? These items are often misunderstood, sometimes ignored, and with injurious results.

"Again, let us ask if the plant is efficient? If not, goods cannot be economically produced by it. Is the management such that the making of spoiled and defective goods is reduced to a minimum, or is there a constant backward stream of 'returned for imperfections'? There are places where through this leak, enough escapes to make a hole in dividends.

"Are there long stops between operations? Do the departments in your establishment run as separate and possibly hostile individuals, with a certain jealousy lest one excel the other, or is there team work; so that they interlock in mutual helpfulness? Is power lost through inefficient transmission or through expensive motive power? What proportion of coal goes for running useless shafting and belts? Is it thought desirable to daily have the bearings oiled and the plant inspected, to keep it at highest efficiency? Are supplies and needed tools convenient, so that long excursions are avoided in getting them and, on the other hand, is their use so regulated that they are not wasted? What about the spirit of operatives? Is it considered proper if they are fifteen minutes behind time to fine them an hour's pay? and if so, by what right does the employer take the pay for those three-quarters of an hour? Was not most of that time spent in work, and is it not in fairness a little like petty larceny to refuse them pay for labor really done?

"Treating this question from our ethical standpoint, may not these things be said to be true? No employer should reduce the wages of his employees for the purpose of increasing his own profit, or for maintaining former or usual profits. No employer should reduce the wages of his employees until he has encountered a shrinkage in his own net income of at least equal percentage to that of which the proposed reduction will deprive his employees. The righteousness is doubtful in a case of an employer with many departments, where one is unprofitable, but others pay well, of cutting the wages of the employees in the unprofitable department to thus make that branch as remunerative as the other lines of the business. It would at least seem fair that every possible and suitable economy should be exercised to make that department pay by other means before such a course were tried, and that even then the question should be most reluctantly, if at all, decided in favor of reducing the pay roll.

"But we come back to our query, already partly answered, What else does the employer owe the employee? He owes him to remember: First, that he and they are alike under the law of mutual service, from which no man can escape. He owes them care for health, and to some extent for life and safety. He would not put valuable apparatus, if it had much leather connected with it, in a damp place; why should he not give men the same consideration? If his output is of a delicate character, he sees to it that his machines are kept clean. Does he not owe it to the employee to give him a chance to be clean also? Or is he content to have a clean machine and a dirty man? In short, does not the employer owe the employee as much care as he would give to a dumb mechanism, and possibly a fraction more?

"There is, there must be, an ethical side to commercial life. This is because the connection is merely one form of the many relations between men, which are all essentially ethical, and in none of which can we escape from the broad duty of loving our neighbor as ourselves. A man is worth more than anything he makes, and that employment is wrong that so places bonds upon a man that he cannot progress while giving some of the proceeds of his labor to another. The influence of a wise and kindly superintendent or employer has often reached far beyond the mill yard and the working hours, and has strengthened and even saved men who were in danger and

needed just this aid. The possession of power brings with it responsibility for its righteous use. We must be either our brother's keeper or his hinderer.

"A gap often divides the workingman from his employer because of imagined diversity of interests, and this, like anything that tends to sever the necessary intercommunication between head and hand, the employer and the workingman, is greatly to be deplored. There is no necessary, indeed no proper, antagonism between the employer and the employee, but on the contrary, the law of mutual service and reciprocal duty is over both. But because of the superior opportunity for usefulness given to the employer, his responsibility and his duty are the greater.

"Kindly recall that we are not urging definite action, remembering that every employer must act within the line of his own opportunities and environment, but are only suggesting principles, inquiring how far these principles may be applied, and urging that so far as is possible they should be applied. It is thoroughly understood that the employer of two thousand men, who will raise each one's wages 50 cents per week, must from somewhere obtain $52,000 per annum. The fact cannot be escaped; it is for such an employer to decide whether it is right that the 50 cents should be paid, and if so, by every possible means strive that the available funds shall be forthcoming.

"In closing our discussion, we recognize frankly limitations that prevent the hasty application of these principles, and which make such application of them undesirable. Inherited distrust and want of sympathy between employer and employee often nullify the real spirit of kindness from one toward the other. The distrust has far too often been justified; the lack of sympathy exists on both sides and limits progress. There is quite as much to be done on the part of the employer to bring about mutual trustfulness as on the other side, and he having a larger outlook and ability should move first. It is not the easier to deal with this suspicion that there exists a certain portion of the press which seems to desire to increase rather than remove the distrust. They sharpen and intensify the antagonism which must be set aside before the spirit of sympathy and appreciation can do its perfect work.

"If we have made our theme at all clear, we conclude that the employer has the larger responsibility in proportion to his greater experience, intelligence, opportunity, and means. We do not urge details of practice or methods of management, but the application of principles. These are not Utopian; they have been put into effect by leading houses in various lines and in different countries, and the results are not regretted. These concerns assert that the course adopted has been profitable. It would be easy to add numerous other examples of the application in fact of the principles suggested. They are sufficiently numerous to prove the truth of the broad principles we have stated. But these principles must be applied along individual lines; they cannot be put into operation everywhere at once, and all that is possible in one place cannot be done immediately. Every man in his own place must work out his own salvation. Racial differences, the elements of competition, of finance, of discipline, the state of the market, and the tendencies of trade, the nature of the business, are all to be considered, but this does not alter the broad fact that the principles are right, and should be applied when and as they can."

An Automatic Feed Portable Drill.

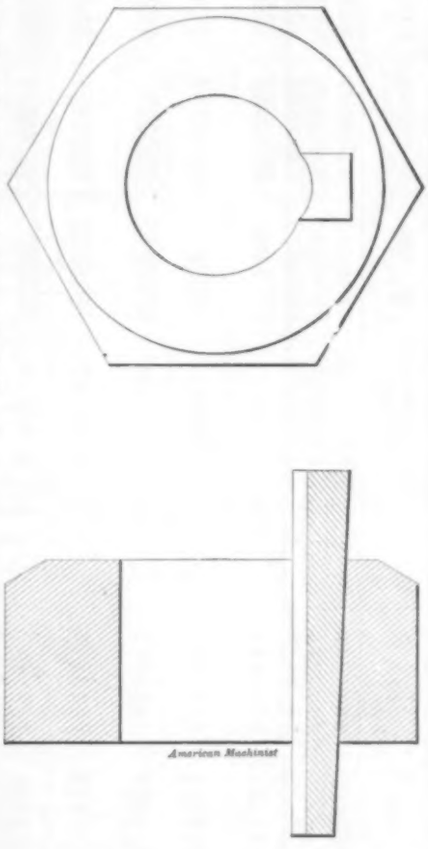
The half-tone shows an interesting, self-feeding, portable, power-driven driller which requires scarcely a word of explanation. The machine, as shown, is driven by a flexible shaft, the speed of which is assumed to be adapted to the requirements, so that there is no provision in the machine itself for varying the speed. The bevel pinion on the driving shaft is protected by a close-fitted shield, and meshes into the large bevel gear, on the hub of which is an eccentric from which a rod connects and gives motion to the small vertical shaft at the left. A pawl on the upper end of this shaft gives motion to a ratchet wheel on the feed nut. By changing the stud in the forked lever at the top of the vertical shaft, the pawl may be made to take from 1 to 7 teeth for each rotation of the drill, corresponding to feeds of 320, 160, 107, 80, 64, 53 and 46 to the inch, respectively. The feed is reversible for backing the drill out if necessary, and the wheel above is, of course, always available for hand feed.

PORTABLE DRILL WITH AUTOMATIC FEED.

The "old man" shown in connection with the driller is worth noticing. Its ready adjustability within all rectangular positions and the security of its fastening will be appreciated. We are rather inclined to regret that the split hub fastening does not appear at the base of the upright as well as elsewhere, as it certainly must be preferable as a fastening to the set screw shown. The drill shown is made in three sizes, the largest driving drills up to 2 inches diameter. Both the machine and the "old man" are made by the Stow Manufacturing Company, Binghamton, N. Y.

Removing Steam Chest Studs.

The accompanying sketch shows a simple yet effective device for removing steam-chest studs without jamming or destroying them, as one is almost certain to do by using a jaw wrench, or injuring the threads, as is very often the case in using jam nuts. It consists, as will be seen, of a nut which has had the thread bored out, leaving a smooth hole, and a tapered key fitted into a key-way which has been cut in one side. It will be noticed that the key is slightly hollowed out on the inner side to allow of two good bearing surfaces *a* and *b*. Place the nut over the stud to be removed, and tap the key down until it has a good strong hold. Apply any strong nut wrench and the tightest bolt can be removed without the least bit of slip. To disengage the nut tap the key on the under side.



FOR REMOVING STEAM CHEST STUDS.

RALPH C. DAVISON.

Table of Strength of Gears.

BY JOHN FITCH.

Since Wilfred Lewis published his valuable formulas for finding the strength of gearing, with means for taking account of features other than the dimensions of the teeth, the reliability and value of his equations have become well established. The actual process of finding the proper dimensions of the pinion and gear to fill certain stated conditions is long, and generally involves trials. None of the diagrams based on these formulas has greatly facilitated the task. Being frequently called on to calculate the proper dimensions of gearing, it seemed to be in the end best to calculate once for all the horse-power of a sufficient number of pinions, and at a sufficient number of speeds to cover all the cases likely to be met. For each pitch, a width of face of average proportion was selected, and these dimensions assigned to pinions of various numbers of teeth. The horse-powers of these pinions, at speeds varying from 100 to 1,000 revolutions per minute, were then calculated, by the use of a Cox computer, and the accompanying table is the result.

From this table the proper gear for transmitting any given power at any given speed, within the limits of the table, can be selected, with no figuring, except in some cases a little mental interpolation. The design of a train of gearing such as is used in ordinary machinery is thus reduced to the simplest and quickest process possible.

Lockport, N. Y.

	No. of Teeth	Pitch. Diam.	50 Revs.		100 Revs.		150 Revs.		200 Revs.		250 Revs.		300 Revs.		350 Revs.		400 Revs.		450 Revs.		500 Revs.	
			H. P.	Ft. Per M.	H. P.	Ft. Per M.	H. P.	Ft. Per M	H. P.	Ft. Per M.	H. P.	Ft. Per M.	H. P	Ft. Per M.	H. P.	Ft. Per M.	H. P.	Ft. Per M.	H. P.	Ft Per M.	H. P.	Ft. Per M.
4" Cir. Pitch. 12" Face.	14	17.98	149	236	231	472	283	706	340	944	365	1075	375	1412	387	1644	399	1888	409	2115	417	2350
	16	20.50	176	268	268	536	328	805	370	1072	395	1340	418	1610	432	1875	444	2144	452	2412	468	2680
	18	23 04	201	304	303	604	363	905	403	1208	430	15-6	452	1810	470	2108	485	2416	500	2710		
	20	25.57	224	335	330	670	395	1004	433	1340	465	1669	485	2008	503	2340	525	2680				
	22	28 40	250	372	357	744	425	1114	460	1488	495	1855	515	2228	535	2600	560	2976				
	24	30.64	270	402	380	804	446	1302	484	1608	517	2002	535	2404	560	2810						
	26	33.18	288	435	402	870	466	1310	509	1740	540	2166	555	2620								
3½" Cir. Pitch. 10½" Face.	14	15.73	104	206	170	412	207	618	235	824	260	1027	273	1236	290	1407	295	1648	305	1850	315	2054
	16	17.95	123	235	198	470	235	705	270	940	290	1173	305	1410	320	1641	330	1880	340	2110	350	2346
	18	20.16	141	264	215	528	260	792	296	1056	318	1317	335	1584	345	1841	360	2112	365	2370	375	2634
	20	22.36	158	292	238	584	285	877	330	1168	341	1460	358	1754	370	2040	385	2336	390	2630	395	2930
	22	24 53	175	321	258	642	310	962	340	1284	365	1600	380	1924	390	2245	405	2568	410	2880		
	24	26.82	190	351	278	702	328	1053	360	1404	388	1752	400	2106	410	2450	420	2808				
	26	29.02	203	380	293	760	343	1140	380	1520	402	1897	430	2280	430	2657						
3" Cir. Pitch. 9" Face.	14	13.48	68	177	110	354	140	529	160	708	178	882	190	1058	200	1233	208	1416	215	1590	220	1764
	16	15.38	80	201	127	402	160	604	184	804	200	1005	215	1208	225	1462	235	1608	240	1810	245	2010
	18	17 28	93	226	146	452	180	678	205	904	222	1127	237	1356	246	1580	257	1808	264	2030	270	2254
	20	19.42	106	254	163	508	198	763	225	1016	240	1268	254	1526	264	1778	275	2032	286	2280	288	2536
	22	21.08	117	276	176	552	212	827	240	1104	257	1377	270	1654	280	1928	288	2208	298	2480	310	2754
	24	22.98	130	301	189	602	224	902	252	1204	270	1500	285	1804	295	2100	300	2408	310	2700		
	26	24 84	138	325	200	650	232	977	263	1300	283	1624	298	1954	307	2273	312	2600	320	2930		
2½" Cir. Pitch. 7½" Face.	14	11.23	46	147	68	294	87	441	103	588	118	654	124	882	130	1026	137	1176	142	1320	146	1470
	16	12 81	52	168	80	336	102	503	118	672	132	838	149	1006	148	1171	154	1344	158	1510	163	1676
	18	14.40	58	189	91	378	114	565	132	756	144	942	152	1130	162	1317	168	1512	173	1690	179	1884
	20	15 98	64	210	101	420	126	628	143	840	156	1044	164	1256	174	1462	180	1680	186	1880	190	2088
	22	17.57	70	230	110	460	136	689	153	920	167	1147	176	1378	185	1605	190	1840	194	2070	200	2304
	24	19.15	76	255	118	570	145	752	163	1020	177	1251	187	1504	195	1750	199	2040	204	2250	212	2502
	26	20.74	83	272	126	544	155	813	174	1088	187	1355	196	1626	205	1897	208	2170	212	2440	219	2710

	No. of Teeth	Pitch. Diam	100 Revs.		200 Revs.		300 Revs.		400 Revs.		500 Revs.		600 Revs.		700 Revs.		800 Revs.		900 Revs.		1 000 Revs.	
			H. P.	Ft. Per M.	H. P.	Ft. Per M.	H. P	Ft. Per M	H. P.	Ft. Per M.	H. P.	Ft Per M.	H. P.	Ft. Per M.	H. P.	Ft. Per M.	H. P	Ft. Per M	H. P.	Ft. Per M.	H. P.	Ft. Per M.
1½ D. P.—2.0944" Cir. Pitch. 5¼" Face.	14	9.33	35	244	54	488	67	733	74	977	80	1221	85	1463	88	1710	91	1960	94	2200	96	2443
	15	10.	38	261	59	523	73	785	80	1047	86	1308	91	1568	94	1832	96	2093	99	2360	102	2617
	16	10.66	42	279	63	558	76	837	86	1117	91	1396	95	1695	100	1954	102	2230	105	2510	108	2792
	17	11.33	45	296	67	593	80	890	90	1187	96	1483	100	1790	104	2077	106	2375	110	2670	111	2967
	18	12.	48	314	71	628	84	943	94	1257	100	1571	105	1885	108	2200	110	2520	114	2835	115	3143
	19	12 66	51	331	75	663	88	995	98	1327	104	1658	109	1990	111	2322	114	2655	119	2985		
	20	13.33	53	349	78	698	92	1047	101	1396	108	1745	112	2094	115	2443	118	2785	120	3140		
2 D. P.—1.5708" Cir. Pitch. 4" Face.	14	7.	16	183	26	366	33	549	38	733	41	916	44	1099	47	1282	49	1465	50	1648	53	1832
	15	7.5	18	196	28½	392	35½	589	41	785	44	981	47	1177	49	1374	51	1570	53	1764	55	1963
	16	8.	19¼	209	30½	418	38	628	43	837	47	1047	50	1256	52	1466	54	1672	56	1880	57	2094
	17	8.5	20¾	222	32½	445	40¼	667	46	890	49	1112	53	1335	55	1577	57	1780	59	2000	60	2225
	18	9.	22¼	235	34½	471	42¾	707	48	942	51	1178	55	1413	57	1649	60	1880	61	2120	62	2356
	19	9.5	23¾	248	36¾	497	45	746	50	995	52	1243	58	1492	60	1741	61	1990	63	2240	64	2487
	20	10.	25	261	38½	523	46¼	785	51	1047	53	1300	60	1570	62	1832	63	2005	65	2352	66	2618
3 D. P.—1.0472" Cir. Pitch. 3" Face.	14	4.66	5½	122	9¼	244	12¾	366	15	488	17	610	18	732	20	855	20	976	21	1100	22	1221
	15	5.	6½	130	10¾	261	13¾	392	16¼	523	18	654	20	784	21	915	22	1046	23	1179	24	1308
	16	5.33	7⅛	139	11⅓	279	15¼	419	17	558	20	698	21	837	23	976	24	1116	25	1255	25	1396
	17	5.66	7½	148	12½	296	16	445	17¾	593	21	741	22	889	24	1038	25	1186	26	1335	27	1483
	18	6.	8	157	13¼	314	17	471	18½	628	22	785	23	942	25	1099	26	1255	27	1415	28	1570
	19	6.33	8½	165	14¼	331	18	497	19¾	663	23	828	25	994	26	1160	27	1325	28	1492	29	1657
	20	6.66	9	174	15	349	19	523	21¼	698	24	872	26	1047	27	1221	28	1396	29	1570	30	1745
4 D. P.—.7854" Cir. Pitch. 2" Face.	14	3.5	2	91	4	182	5	274	6½	365	7½	456	8	548	8¾	639	9¼	730	9¾	822	10	913
	15	3.75	2½	98	4½	196	6	294	7	392	8	490	8¾	588	9½	686	10	785	10½	883	10¾	981
	16	4.	2¾	104	5	209	6¼	314	7½	419	8½	523	9¼	628	10	733	10½	837	11	942	11½	1047
	17	4.25	3	111	5	222	6¾	333	8	445	9	556	10	667	10½	778	11¼	890	11¾	999	12	1112
	18	4.5	3	117	5½	235	7¼	353	8½	471	9½	589	10½	706	11	824	11¾	940	12¼	1060	12½	1178
	19	4.75	3½	124	5¼	248	7½	373	9	497	10	621	11	745	11½	870	12¼	995	13	1120	13	1243
	20	5.	3½	130	6	262	8	392	9½	523	10½	654	11½	785	12	916	13	1047	13¼	1178	13¾	1309

HORSE-POWERS OF CAST IRON CUT PINIONS.

CALCULATED BY WILFRED LEWIS'S FORMULAS.

The Friction of Locomotive Slide-Valves.*

BY JOHN A. F. ASPINALL.

Experiments upon the friction of the slide valves in a Great Southern & Western Railway Company's engine were described by the author in a paper read before the Institution in 1889. They were tried with valves resting against a vertical face, on an inside-cylinder engine, the steam chest being between the cylinders. The author considered it possible that the friction of slide valves when resting upon a horizontal face might be somewhat different from that of valves resting upon a vertical face, and he also desired to test the advantages to be obtained from partial balancing. The following experiments were therefore carried out upon a Lancashire & Yorkshire Railway engine at Horwich, the engine being fitted with Joy valve gear, Fig. 1.

The recording apparatus was similar to that used in the experiments of 1889, although some of the minor dimensions were altered to suit the special engine under trial. In the discussion on the paper referred to, opinions were expressed that an apparatus furnished with a diaphragm in the hydraulic cylinder, instead of with leathers, would be more satisfactory; but careful experiments conducted with a view of using such an apparatus resulted in its being abandoned, and the older form with leathers was employed. Every care was taken to calibrate the apparatus beforehand, and to ascertain the limits of error which could be allowed for in the final experiments. One end of the cylinder was securely fixed to an upright stand bolted to a table, Fig. 2. At the opposite end of this lever was fixed a spiral spring, which was designed to give 3 inches of elongation, or 1 inch per cwt. of load. This large deflection was necessary to secure accuracy of the readings. The spring was fastened to the top knife-edge, the bottom being secured to a swivel and screwed rod, the latter working in a plate screwed to the floor, and having a handle with two ends to ensure smoothness of working; the swivel was fitted with an arrangement to prevent its turning while being screwed. The load or elongation of the spring was shown by a long brass graduated bar fixed to the top shackle and sliding at the bottom in a guide fixed to the swivel. The spring before calibration was loaded for some days with dead weights, to ensure that all distortion of the ends and permanent set were eliminated, and after being used it was again tested. The lever and appendages were accurately balanced by means of the balance weight attached to the lever.

In the 1889 experiments, the indicator diagrams, which were taken to show the work done in the engine cylinder at the same moment that the friction diagrams were taken from the dynamometer, were of the ordinary length, the motion being obtained by suitable mechanism from the piston crosshead; but in the present experiments the motion was obtained from the valve-spindle crosshead, this being considered a more accurate method of ascertaining the steam-pressure at any

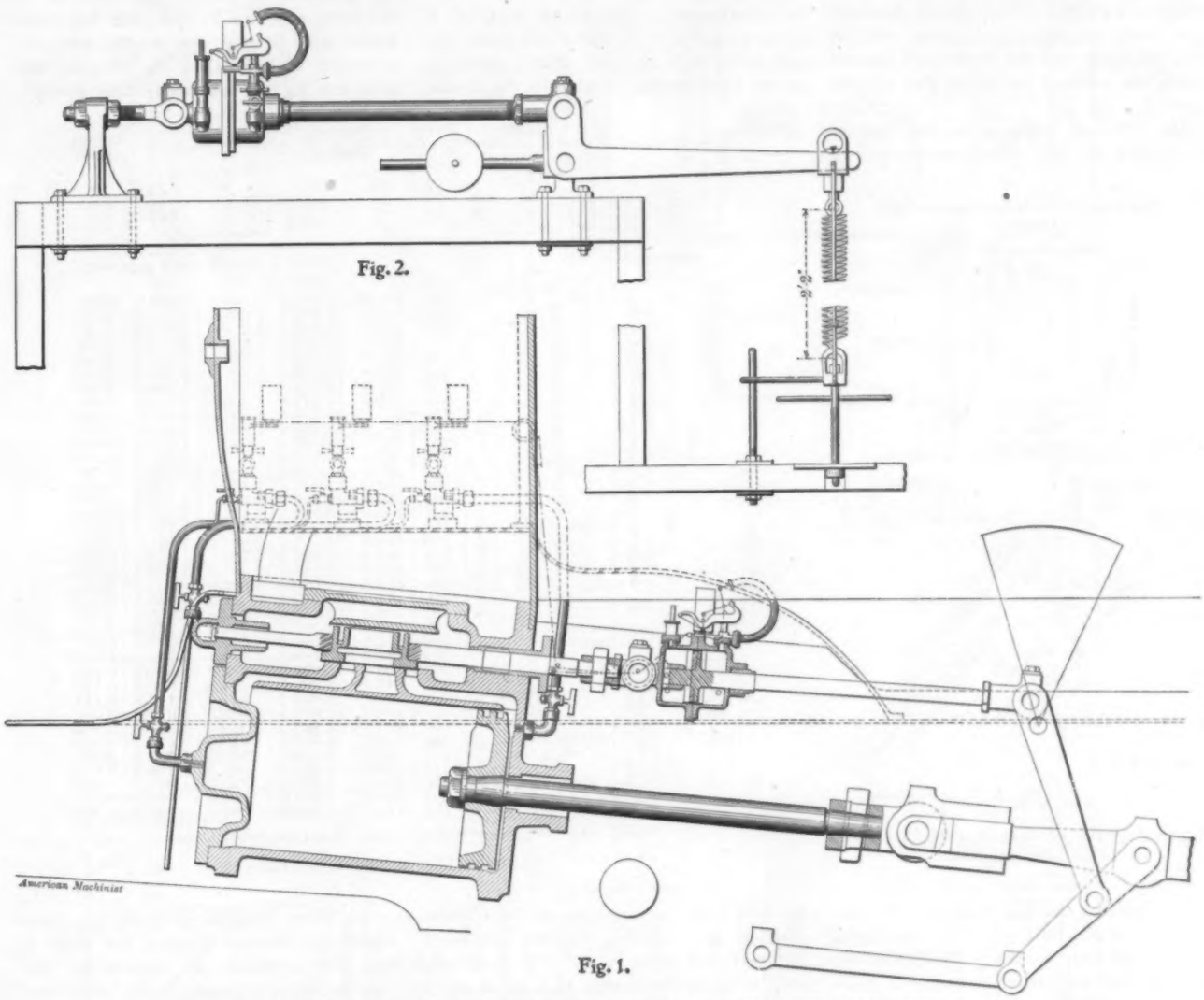


Fig. 2.

Fig. 1.

APPARATUS USED IN MEASURING THE FRICTION OF LOCOMOTIVE SLIDE VALVES.

*A paper read before the British Institution of Civil Engineers.

known position of the valve. It then became easy to obtain a simultaneous record giving a friction diagram, a steam-chest diagram and a steam-cylinder diagram, thus eliminating any error that might have been present had these diagrams been taken one after another.

The valve-spindle was so packed as to be easily moved up and down in its position by hand. The speeds at which the diagrams were taken varied between 6 miles and 18 miles per hour. Two kinds of valves were experimented with; one, an ordinary D valve made of phosphor-bronze; and the other of Richardson type, with an open back, made of cast iron, the strips and the fixed plate against which the valve slides being also of cast iron.

The annexed table gives the leading particulars of the steam-pressures and

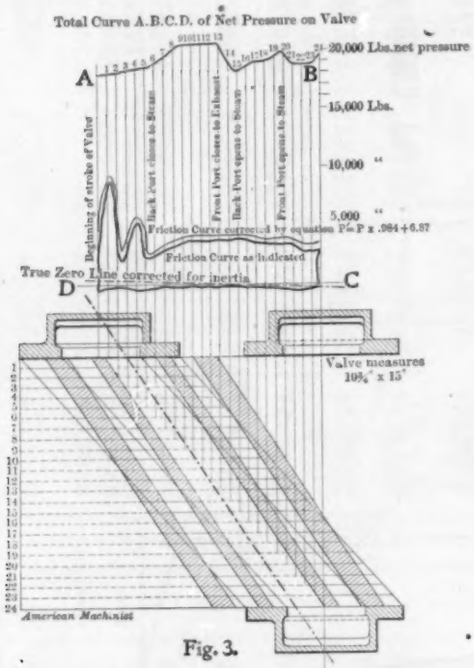


Fig. 3.

FRICTION CURVE COMPARED WITH POSITION OF VALVE.

pressed as to the advantages to be obtained from balancing. As a sight-feed lubricator was used in the experiments, it was easy to watch the result of increasing the number of drops of lubricant per minute, and it was found that there was a perceptible improvement in the ease of movement of the valve when the lubricant was increased.

A friction diagram obtained automatically is shown in Fig. 3, while above it in dotted lines is plotted the diagram corrected by the equation $P_1 = P \times 0.984 + 6.87$, an expression arrived at after careful experiments. Below that diagram is given a section of the valve and valve face and ports, showing their relative positions at any intermediate portion of the stroke,

In connection with the 1889 experiments, opinions have been expressed that the use of the whole of the area of the back of the D-valve, when estimating the coefficient of friction, was erroneous; on the ground that the only area affected by the pressure in the steam-chest was an area equivalent to that of the steam-ports. The argument is that if a flat plate of the same superficial area as the back of the valve were moved over another plate of the steam-chest, there would be no friction; but if the lower plate had a hole, say 2 inches in diameter, bored into it, the force required to move the flat plate would only be that due to the pressure of steam multiplied by the area of the hole, and as this opening became greater,

Forward or Back Gear.	Notch, 1 to 4.	Push or Pull.	Lubrication.	Type of Valve.	Boiler Pressure.	Steam-chest Pressure.	Net Pressure on Valve.	Total Force on Diaphragm, corrected.	Total Force Moving Valve.	Coefficient of Friction.
			Drops per min.		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	
F.	1	Pull.	4	Phosphor-Bronze "D" Valve.	156	155.0	24,149.0	1,549.5	2,099.0	0.086
"	1	"	4		152	151.5	23,562.5	1,589.0	2,126.0	0.090
"	2	"	4		158	154.0	23,405.0	1,510.5	2,056.5	0.087
"	2	"	4		157	153.0	23,037.0	1,497.0	2,039.5	0.088
"	3	"	4		144	137.0	19,513.0	1,090.0	1,575.5	0.080
"	3	"	4		154	150.0	21,619.0	1,562.5	2,094.5	0.092
"	4	"	4		146	140.0	19,455.5	1,234.0	1,730.5	0.088
"	4	"	4		158	150.0	21,077.5	1,392.0	1,924.0	0.091
B.	1	"	4		158	155.5	23,894.5	1,497.0	2,048.5	0.085
"	1	"	4		149	154.5	23,929.0	1,497.0	2,045.0	0.085
"	2	"	4		152	150.0	21,924.0	1,444.5	1,976.5	0.090
"	2	"	4		155	147.5	22,052.0	1,313.0	1,836.0	0.083
"	3	"	4		150	145.5	20,824.0	1,300.0	1,816.0	0.087
"	3	"	4		156	151.5	21,801.5	1,300.0	1,837.0	0.084
"	4	"	4		155	152.0	20,819.5	1,103.0	1,642.0	0.078
"	4	"	4		147	140.0	19,248.5	1,129.0	1,625.5	0.084
F.	1	Push.	3		160	157.5	24,461.5	3,326.0	1,767.0	0.072
"	1	"	6		158	156.5	24,291.5	2,866.0	2,311.0	0.095
"	2	"	6		159	150.0	22,907.0	1,709.0	1,177.0	0.051
"	3	"	5		160	136.0	20,568.0	2,347.5	1,865.5	0.090
"	3	"	3		159	152.0	23,032.5	1,503.0	964.0	0.041
"	4	"	3		160	148.0	20,941.5	2,620.5	2,095.5	0.100
"	4	"	3		161	148.5	20,736.0	2,532.0	2,005.0	0.096
B.	1	"	3		160	147.0	22,502.5	2,973.5	2,452.0	0.108
"	1	"	3		158	152.0	23,732.0	1,915.0	1,376.0	0.057
"	2	"	3		158	142.0	21,184.5	2,826.5	2,322.5	0.109
"	2	"	3		164	160.0	23,605.5	3,326.0	2,758.5	0.112
"	3	"	3		158	147.0	21,292.5	2,914.5	2,393.0	0.112
"	3	"	3		160	150.0	21,677.0	2,944.0	2,412.0	0.111
"	4	"	3		158	140.0	19,995.0	2,468.5	1,972.0	0.098
"	4	"	3		160	145.0	21,165.5	2,503.0	1,988.5	0.093
"	1	Pull.	4	Balanced.	144	140.0	9,467.0	420.0	916.5	0.097
"	1	"	4		142	140.5	9,514.5	393.5	892.0	0.094
"	2	"	4		140	133.0	8,633.0	288.5	760.5	0.088
"	2	"	4		158	154.5	9,976.0	393.5	941.5	0.094
"	3	"	4		143	140.0	8,704.0	354.0	850.5	0.097
"	3	"	4		152	149.0	9,238.0	236.0	765.0	0.082

NOTE.—The regulator was full open in all the experiments.

TABLE OF DETAILS OF EXPERIMENTS.

other points of importance; the coefficient of friction in each case being given in the last column. Thirty-one sets of diagrams were taken with the D phosphor-bronze valve, the average coefficient of friction being 0.0878, and six diagrams were taken with the cast-iron Richardson valve, the average coefficient of friction being 0.0919. In the partially balanced valve, the balanced area was taken as being that portion which is enclosed between the strips, excluding the area of the strips themselves. Two diagrams are given for illustration; Fig. 4 being for the phosphor-bronze valves, and Fig. 5 being for the cast-iron Richardson valves.

The good results obtained with the Richardson valves have caused the author to modify the views he previously ex-

by following the ordinate of the friction diagram down until it cuts the section of the port and valve faces. The true zero line, corected for inertia at a speed of 15 miles per hour, the speed at which the diagram was taken, is also shown.

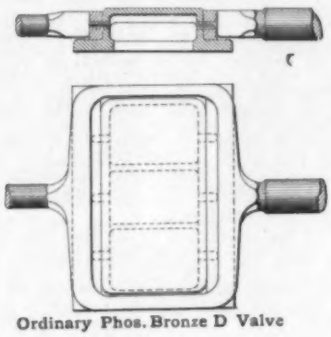
The experiments show that the friction of slide-valves is somewhat greater against a horizontal than against a vertical face; the coefficient of friction found in the 1889 experiments for valves on a vertical face was 0.068, while in the experiments dealt with in the present paper, the average coefficient was found to be, for the unbalanced valve 0.0878, and for the partially balanced valve 0.0919. There is a considerable advantage in having to overcome a force of only 854.3 pounds for the balanced, as against a force of 1946.18 pounds for the unbalanced valves.

so the force required to move the valve would also become greater. In order to test this question, an experiment was made on another engine of the same class. A cast-iron plate was laid upon the ordinary valve-face, and through it a 2-inch hole was bored. An ordinary phosphor-bronze unbalanced D-valve worked upon it, and the same dynamometer and recording arrangements were used for these experiments as for those recorded in the first part of the paper. With this arrangement, Fig. 6, it was found that a force of 2,195.9 pounds was required to move the valve with a pressure of 160 pounds per square inch in the steam-chest. The plate was then taken out and the 2-inch hole was enlarged to 4 inches, and five 1-inch holes were drilled over each of the steam ports, Fig. 7. The dynamometer recorded

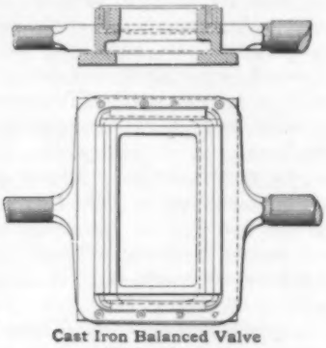
exactly the same force of 2,195.9 pounds under these conditions. The intermediate plate was then removed and the valve was dropped upon the ordinary cylinder face, Fig. 8, with the result that exactly the same force was found to be necessary to give movement to the valve. The author is of opinion that this experiment disposes of the view that the area of the steam-ports only should be taken into account.

In the discussion Mr. Aspinall stated that there were three indicators, Fig. 1, on the cylinders outside the smoke-box. One showed the pressure of the steam on the front end of the cylinder, the other on the back end, and the third in the steam-chest. On the dynamometer a Kenyon indicator was placed, and the diagrams were all taken simultaneously.

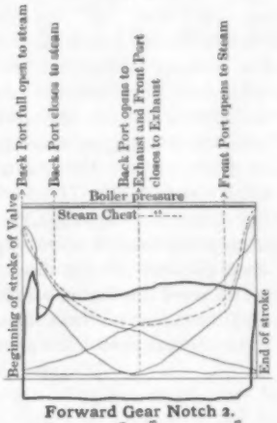
With regard to Figs. 4 and 5, the difference in area between the lower diagram in Fig. 4 and the upper one in Fig. 4, shown in hard black lines, which measured the valve friction, was due to the pressure in the steam-chest on the end of the valve-spindle, which assisted the valve-spindle in moving in one direction, and retarded it in the other direction, in consequence of which a larger diagram was given below than above.



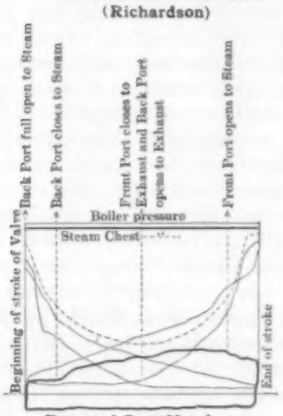
Ordinary Phos. Bronze D Valve



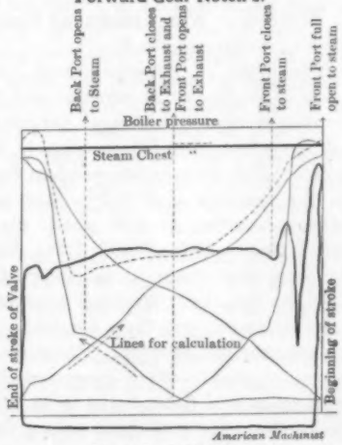
Cast Iron Balanced Valve (Richardson)


Back Port full open to steam
Back Port closes to steam
Back Port opens to Exhaust and Front Port closes to Exhaust
Front Port opens to Steam
Boiler pressure
Steam Chest
Beginning of stroke of Valve
End of stroke

Forward Gear Notch 2.

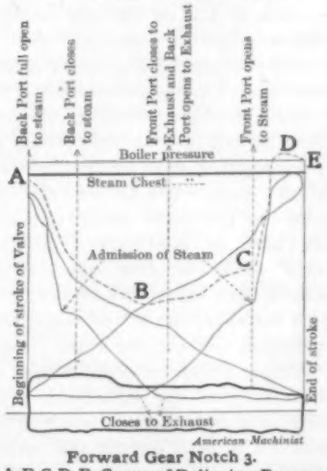

Back Port full open to Steam
Back Port closes to Steam
Front Port closes to Exhaust and Back Port opens to Exhaust
Front Port opens to Steam
Boiler pressure
Steam Chest
Beginning of stroke of Valve
End of stroke

Forward Gear Notch 2.


Back Port opens to Steam
Back Port closes to Exhaust and Front Port opens to Exhaust
Front Port closes to steam
Front Port full open to steam
Boiler pressure
Steam Chest
Lines for calculation
End of stroke of Valve
Beginning of stroke
American Machinist

Back Gear Notch 3.

Fig. 4.



Forward Gear Notch 3.
A.B.C.D.E. Curve of Relieving Pressure

Fig. 5.

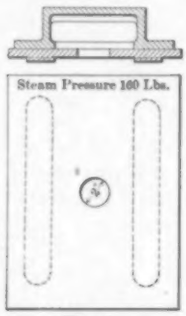


Fig. 6.

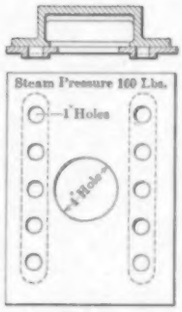


Fig. 7.

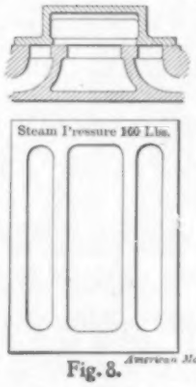


Fig. 8.

THE VALVES TESTED AND DIAGRAMS TAKEN.

[These experiments answer a stock question of many years' standing, and to us they are of the first order of interest. It seems odd, however, that anyone could have supposed that the enlargement of the 2-inch hole of Fig. 6 could have any effect on the load carried by the valve or on its friction. It has been considered by many that the area of the cavity in the valve should be made the basis of calculations of valve friction, but this is a very different thing from the area of the hole. Mr. Aspinall's experiments seem, however, to dispose of the rational cavity theory as well as the absurd hole theory, wherein their results differ from those obtained by Professor Robinson some years ago. Inasmuch, however, as Professor Robinson's experiments were made on laboratory apparatus which did not in all respects repeat the conditions of a valve at work, his conclusions would seem to be disproved by Mr. Aspinall's experiments, though it is not easy to account for the diametrically opposite indications of the two sets of experiments.—ED.]

Letters from Practical Men.

Belts and Belt Dressings.

Editor American Machinist:

That it is necessary to apply to leather belts some sort of a dressing from time to time is generally conceded. That whatever preparation is used should be of such composition as to suit the particular conditions of speed, temperature, humidity and other circumstances would seem to be indisputable. Belts running in a dry and hot location require oil to keep them soft and pliable, and to insure such an adhesion to the pulley as to enable them to transmit the power proportioned to their width and velocity. Otherwise the belts will dry up, crack and become worthless in half the time that they should. Belts running in a moderate temperature, and where the oil from machinery occasionally splatters on them, will usually get more oil than they need, and if mineral oil is used, it is apt to do more harm than good.

Where oil is applied to belts, it would seem that an animal oil would be preferable, although castor oil seems to have many friends. The engineer usually has his own favorite preparation for the main belts, and his preference generally works well when he uses it himself, but not always as well if issued to the workmen throughout the shops. Therefore the necessity still remains for the use of some kind of belt dressing that may be put in the hands of employees generally for use by them as occasion seems to demand. These occasions are usually when a belt slips from becoming dry and hard, and occasionally where a belt is required to transmit for a limited time a greater power than was originally intended.

After using and seeing used many of the usual belt dressings in the market, experiments were made to ascertain what composition would be best suited for ordinary, everyday use in the shop, and the following compounds are the result. These preparations have been in use for several years, and give good satisfaction.

For a liquid dressing, to be used in summer, take: Beeswax, 4 pounds; pitch, 5 pounds; resin, 3 pounds; neatsfoot oil, 13 pounds. Melt the beeswax first, and add the other ingredients in the order named.

For the same dressing for winter use, the neatsfoot oil should be increased to 15 pounds.

For a solid preparation for summer, take: Beeswax, 6 pounds; pitch, 5½ pounds; resin, 7 pounds; neatsfoot oil, 1 pound.

For winter the resin should be reduced to 6½ pounds.

This composition is prepared in the same manner as before, and poured into molds of convenient size—say, 3 x 6 inches and 1½ inches deep. These molds may be of metal or wood. They should be so constructed as to be easily taken apart, as the preparation adheres quite strongly to them. To avoid this, they may be rubbed over with chalk, whiting or graphite.

As to the relative qualities of the solid and fluid preparations, it may be said that the fluid state is the best if it is properly used, but that it is so readily applied that, ordinarily, two or three times as much is applied as is necessary. On the contrary, that in a solid form, being held against the running belt until a sufficient quantity is carried off, is not so apt to be wasted, and is therefore more economical. But it is also to be considered that the solid preparation does not contain as much neatsfoot oil as the liquid, and this oil is valuable as a preservative. Hence, the choice should be made with reference to these features.

As to cost, it is, at present prices, as follows, taking the solid preparation for winter use:

6 pounds beeswax, at 35c.	$2.10
5½ pounds pitch, at 8c.	.44
6½ pounds resin, at 4c.	.26
1 pound Neatsfoot oil, at 12½c.*.	12½
19 pounds.	$2.92½

Which is practically 15½ cents per pound. The liquid is within a small fraction of the same cost; so that it will be seen that it is not expensive. The expense might be still reduced, but practice indicates that, all things considered, the above proportions will give the best satisfaction.

OSCAR E. PERRIGO.

New Haven, Conn.

*Neatsfoot oil at $1 per gallon of 8 pounds, very nearly.

Paying For Work by Area.

Editor American Machinist:

In the number of the "American Machinist" for December 29, 1898, there is an article on "Paying for Machine Work by Area of Tooled Surface."

In my experience on piece work graded in this manner I have found there is always room for contention among the men. For an example, suppose we have 500 pieces of cast iron 24 inches long, 3 inches in diameter, to turn up to standard size to fit snap gage. We have in the shop two lathes of the same make, one of which has been in continuous use for three years, while the other was very recently bought, both apparently in good condition, with the exception of the ways, which are somewhat worn in the older lathe.

We put a man on each machine and pay them both at the same rate per square inch; and right here is where trouble begins. The man on the old lathe claims that his machine is worn so much that it will not turn straight, and consequently he has to spend more time filing his work in order to turn it out satisfactorily, than the other man on the new lathe; and in various ways the men always find something to complain about that continually keeps the foreman in hot water and busy adjusting difficulties.

From my experience and observations with men on piece work graded by "superficial areas," and by various other methods, I find it is the cause of more petty dishonesty, personal contention, internal shop troubles and strikes than any other form of complaint that I am aware of. I cannot at this writing find words to adequately express my condemnation of piece work in machine shops.

ANOTHER FOREMAN.

Lathe Footstocks.

Editor American Machinist:

The subject of footstock clamps has been touched on by several of your correspondents lately, who tell how the footstock should have been made, but have nothing to say in regard to fixing up an old footstock already in existence, so that it will approximate the ideal for which they are yearning.

If the footstock is of the box pattern, as with the majority of American lathes, two pieces of wood may be cut of such a length that they will be a driving fit in the lower part of the box, and form a slot standing crosswise of the lathe, in which the two bolts can dangle and move crosswise for set-overs; but will be restricted in their fore and aft swing, in a way that will delight the hearts of Messrs. MacCarthy and Clegg, so these gentlemen will not have to give the clamping nuts over a half turn each. The wood pieces need not drive so very tight, as there is no tendency for them to come out except their own gravity. It has been my misfortune to work on lathes of faulty design, and the clamps I have fixed in this way quite cheaply, yet with good results.

WALTER GRIBBEN.

Were the Machinists at Fault?

Editor American Machinist:

The letter of Superintendent, in your issue of December 29, must attract the attention of most machinists. Of course we all have met the fellow who is always weary. But does Superintendent find him in the machine shop only. Are not the other departments also good places in which to look for him? Has Superintendent ever made it an object for his men to use their thinking apparatus, or does he merely pay them for what jackass power they can develop. There are shops, many of them, where every man knows that upon him depends, to some extent at least, the welfare of the company that employs him. Has not Superintendent let his men get into a rut from which they need something like an electric shock to wake them?

His statement that the majority do their work as it was done twenty-five years ago would lead one to think such must be the case. But is it? It is but a few years since standard gages and micrometer calipers were unknown in most shops; now an up-to-date shop cannot do without them. Does Superintendent encourage his

men to study their work, also drafting and mechanical papers and books? Does he deny admittance to the shop of reliable agents for machinists' tools. One man with a good kit is an object lesson for all. How about the tool room; is it run on a liberal plan? Is the man in charge a hustler? and does he keep all the tools ready for use, or do the men have to wait his motions? Is there any record kept of the tools that are injured, so that the fellow who is heedless, and spoils work and tools, can be cautioned, and then be replaced by a better man if he persists in being a bull? Are Superintendent's foremen able to convince their men that a "pull all together" is the only way to success? Or are they envious of each other, and ready to blame poor work on every department but their own? We can show Superintendent several shops where he would have to admit that the machine tools were worked to their full capacity, and at a reasonable cost for help. I would like to visit his shop and see his method of doing work. YELNATS.

Some Every Day Shop Notes.

Editor American Machinist:

Whenever the subject of hardening and tempering steel is mentioned, it is apt to be regarded as a joke; but you don't notice the joke yourself, when you try to harden and temper a tool, and when the job is done have to do it over again. The tempering and also the hardening process require your best care, and if you do it in a hurry, and especially if you try new ways, the chances are that you may discover one good way, and half a dozen ways how not to do it.

To begin with, the steel must be good. Try to harden a piece at a red heat and cool it in cold, clean water, and if it cracks, let it alone. We have seen the advice given in a little book, to test every lot of steel to see if it is adapted for the purpose, before making any of it into tools, and as usual, you are likely to read the advice first, and then find afterwards, from experience, why the advice was given.

To make a lathe tool, heat the part to be forged in a gas forge. It will be difficult to overheat the steel in a small gas forge, using proper care. Give it nearly the required shape, leaving any sharp corners or small projecting parts to be shaped afterwards with a large file. After forging, heat the tool until it is just red hot, and turn off the gas at once, leaving the tool in the forge to cool as slowly as possible. When cool, the file will, or should, cut it easily, and by filing the scale off, and also the thin, soft surface, you get a smooth, clean cutting edge, which is all steel, and will harden well. But, no matter how a piece of steel is hardened, it seems as though the extreme sharp edges are always softer than the metal under the surface, which is exposed when a tool is ground, and the reason that this may not be noticed is that the tool is ground before using, and so this soft covering is removed, or it may be so thin as to cause no difficulty. But take a tool just as it is forged, which may have been heated half a dozen times before the forging is complete, and with a sufficient covering of "scale" on it, then heat it and harden, and test the extreme edges with a new file, and see if they are not softer than the body under the surface.

But the tool is ready to be hardened now, and so it is heated red hot once more, and cooled promptly in a sufficient quantity of cold water. I have hardened steel in water very dirty and as black as ink, with both soapsuds and oil in it, and while the steel will harden, it is undoubtedly not a good way. Grind the cutting parts of the tool all over, to give a bright surface for tempering, so that you can see what you are doing. Heat on an iron plate, or heavy sheet iron, about 1-16 inch. or more, thick, over a gas or gasoline burner, and regulate the flame to give a low heat, and heat the tool on the plate until the bright surface shows a straw color (though it will be safer to let the straw color get a little too dark in tint, rather than too light), then cool promptly in cold water, grind the cutting edges slightly again, and the tool should then be in good condition. If in doubt as to when the right color for tempering has been reached, hold a screw-cutting die—one with the tempering color on it—near the tool in process of tempering, and when both tints are alike, you will probably have a straw color. Now test the tool with a new file—a small one with fine teeth—and see if the file will cut off any sharp corner. If it will just file away a small portion with difficulty, the tool will do.

If lard oil is mixed with 2 parts of kerosene oil, the mixture answers every purpose of pure lard oil. For some purposes the proportion of kerosene oil might be increased to 3, 4, or even 5 parts, to 1 part of lard oil; and when it is remembered that the quantity of oil which actually lubricates the cutting edge of a tool, is small compared to the quantity used, there is really no reason why the lard oil should not be diluted by mixing with some other and cheaper substance.

I recently used a crystal of carborundum to true up a grindstone, using it in much the same way that a tool is used in the lathe, and can make a grindstone run perfectly true, or as near true as may be desired, in this way, holding the crystal in any convenient way for feeding it across the face of the stone by hand. For instance, in the case I speak of, the crystal was held in a pair of pliers. S. E. F.

Horse Power Graphics.

Editor American Machinist:

While two or three of us have lately, in the columns of the "American Machinist," had something to say about horsepowers, I cannot think that we have left the subject in very satisfactory shape. It does not, as it stands, look like a completed job, and I have a notion to try my hand at it again, if I may be sure of the patience of the congregation.

There is no subject, perhaps, which more needs to be looked at from different sides, in order to get a complete understanding of it, than this subject of horsepower, and especially that part of it which has to do with the propulsion of vehicles, or, still more minutely, with the starting and stopping of them. We have only to look into the matter a very little before we encounter a rather curious thing. While the greatest actual power, as measured by our horse-power standards, may be required and may be expended in keeping a vehicle going at a high speed, it may still often happen, and, in fact, it does generally happen, that a motor which is quite competent and sufficient to maintain the speed is wofully deficient in power when starting from a state of rest, and in the first stages of acceleration. I don't mean a mechanical motor entirely, either. A horse may trot along the road drawing a sulky twenty miles an hour with pride and satisfaction, and the same horse may make a most humiliating exhibition of himself in trying to haul a loaded canal boat out of a lock, yet in the former work doing a fair horse-power by actual measure and computation, while in the latter case actually doing, perhaps, not one-tenth of a horse-power, according to the same methods of measuring and stating the power.

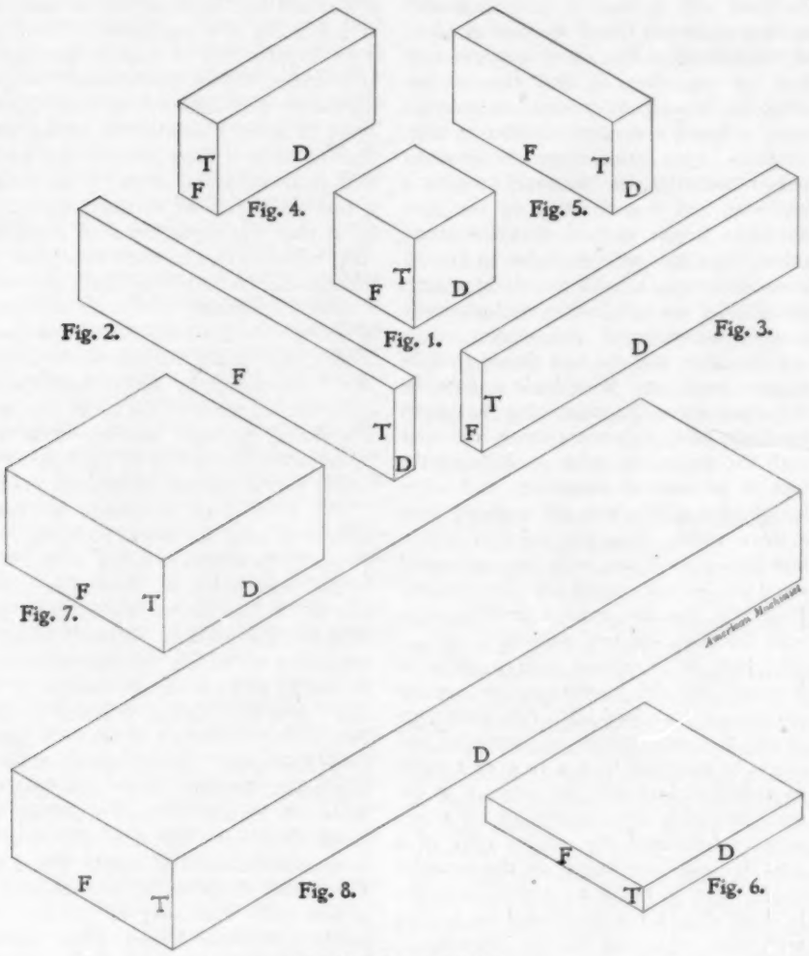
This method of statement of horsepower is what is worth looking into. Power is the means of doing work. Work is the overcoming of resistance, and of course involves not merely force or pressure, but also motion. When it comes to measuring or stating the rate of work, or the ability to do work, the element of time also comes in. Measured power is therefore always a product of the two factors, force and speed. Speed, again, or rate of movement, includes both time and distance. A certain distance traversed in a given time, with uniform rate of movement, is a statement of speed. There must always be, therefore, to any measure of power three elements; or power is the product of three factors, force, distance and time, as in the case of the standard horse-power of 33,000 pounds per foot per minute.

This 33,000 foot-pounds per minute, then, or any other power statement, having the three factors of force, distance and speed, may be represented by a solid rectangular figure, the three normal dimensions of which may be taken to represent, in due proportion, these three factors. If we could get into the habit of looking at power in this way it might help us to a clearer conception of it. The vastly different shapes which the figure may take and still represent the same power will show the varying conditions of power development and employment. Thus the

isometric cube, Fig. 1, may be taken to represent a standard horse-power, the dimension T being the time, one minute; F the force, 33,000 pounds, and D the distance, one foot, through which the force is exerted in the given time.

It is necessary for me to speak right here of the one thing that I have against James Watt. I understand and appreciate as much as anyone that he did a vast number of things vastly better than any other man could have done them; but why in the world, when he was fixing the horse-power standard for a long time ahead, if not for all time, why could he not just as well, why should he not have done it, and why did he not make it 32,000 pounds instead of 33,000 pounds? Especially as the horse-power is universally conceded to be too big anyway, it is almost unaccountable that he did not give us the figures so capable of continued subdivision instead of the others that you begin to be inconvenienced with as soon as division is attempted. The only explanation which occurs to me is that while James Watt was the most prominent figure of his age—that is, as we look back upon it—or perhaps the most prominent figure of all the ages, he was not a figurer. That the other men of the engineering world who go in for easy arithmetic have not insisted upon the more convenient figures for everyday use, may be explained by those who can explain why the centigrade thermometer is not universally adopted.

It will certainly be easier for us to use the 32,000 pounds here, and I proceed at once to do it. We will confine our attention just now to the first four figures here shown. It will be noticed that they each have the same cubical contents, or represent the same work done in the same time, or the same horse-power. In Fig. 1 we have T, or time = 1 minute; F, or force, = 32,000 pounds, and D, or distance, = 1 foot, or the combination represents 32,000 foot-pounds per minute. In Fig. 2 T = 1 minute, as before; F = 32,000 × 4 = 128,000 pounds, and D = 1 ÷ 4 = ¼ foot, and 128,000 × ¼ = 32,000 foot-pounds as before. In Fig. 3 T again equals one minute, F = 32,000 ÷ 4 = 8,000 pounds, and D = 1 × 4 = 4 feet, and 8,000 × 4 = 32,000 foot-pounds as before. In Fig. 4 F is doubled and D is reduced one-half, giving the same product as the others. In Fig. 5 D is doubled and F is halved, giving again the same result.



HORSE-POWER GRAPHICS.

The figures here shown only afford a mere hint of the diverse conditions which may prevail in traction problems. The differences in conditions may easily be so great as to make it practically impossible to show the extremes in any two diagrams drawn to the same scale for both. If Fig. 1 be taken to represent the work of a high-speed passenger locomotive drawing a train at a mile a minute, T being the minute, F being the drawbar pull of, say, 1,000 pounds, and D being the mile, or 5,280 feet, we have 1,000 × 5,280 ÷ 33,000 = 160 horse-power. Now to represent, on the same scale, the work of a locomotive when starting a freight train, with a drawbar pull F of, say, 10,000 pounds and a movement D of, say, 5 feet per minute, the horse-power then being 10,000 × 5 ÷ 33,000 = 1.5, F would have to be ten times as long as in Fig. 1, while D would be less than one-thousandth of its present length. The solid represented would be like a strip of the thinnest tissue paper ever seen and, say, 5 inches long and ½ inch wide, and stood upon its edge. If, on the other hand, Fig. 1 were taken to represent the slow pull of the freight engine, as above, then to show the work of the lightning express, with the same data as previously used, F would become only one-tenth of its present length, while D would be more than a thousand times as long as now, or, say, 44 feet.

In the first five figures that we have considered, and also in the locomotive examples cited, the time has been assumed to be 1 minute in each case, and to be represented by the same vertical length. There are really only two of the three dimensions in these figures that indicate the work done. These are, of course, F and D, or the force exerted and the distance through which it operates, the two in combination representing the foot-pounds. The third particular, or the time measured, indicated by T, is, however, essential in any statement of the horse-power, or the rate at which the work is done. We must not here be misled into taking the cubical contents of the figures as representing the horse-power. The dimension T has an inverse instead of a direct value. Thus, comparing Figs. 6 and 7, in which both the force and the distance are double those of Fig. 1, and whose product therefore is four times that of Fig. 1, and the work done also four times as great, Fig. 7, with four times the cubic contents of Fig. 6, really represents only one-fourth the horse-power of Fig. 6, because it represents the doing in one minute what in Fig. 6 is done in a quarter of a minute. Fig. 8, with sixteen times the cubic contents of Fig. 6, really represents the same horse-power. In this figure, as the time of operation is four times as great, the distance through which the force operates must also be four times as great. In either of these figures, 6 or 8, the force is the same and the speed is also the same, because the distance traversed is four times as long in the one-minute diagram,

Fig. 8, as in the quarter-minute diagram, Fig. 6. If the dimension T is taken inversely, Figs. 6 and 8 will figure up to the same horse-power. Fig. 1 represents 1 horse-power, or 32,000 foot-pounds, T being one minute, F being 32,000 pounds, and D being 1 foot. In Fig. 6 T is one-fourth of T in Fig. 1, F is twice and D is twice as great as in Fig. 1. Then (32,000 pounds $\times$ 2) $\times$ (1 foot $\times$ 2) $\div$ ¼ = 512,000 foot-pounds = 16 horse-power. In Fig. 8 T is the same as in Fig. 1, F is twice the F in Fig. 1, and D is eight times as great as in Fig. 1. Then (32,000 pounds $\times$ 2) $\times$ (1 foot $\times$ 8) $\div$ 1 = 512,000 = 16 horse-power. In Fig. 7 T is the same as in Fig. 1, F and D are both twice as great as in Fig. 1. Then (32,000 $\times$ 2) $\times$ (1 $\times$ 2) $\div$ 1 = 128,000 foot-pounds = 4 horse-power.

TECUMSEH SWIFT.

A Die That Was Too Sharp.

Editor American Machinist:

In your issue of December 29, 1898, I notice a mistake in one of the illustrations of my article on the "Manufacture of Shell." The stripping die is shown with a sharp cutting edge. This form of die was used at first and it was found impracticable for the following reason: In most cases the chamfer was not concentric with the external surface of the shell, and in consequence the die was obliged to cut more on one side than on other parts of the shell. The result was that whenever this form of die was used it would gouge into that portion of the shell on which the cut was heaviest, and so ruin it. This was overcome by grinding the die so that it presented at its cutting edge a surface normal to that of the shell. No difficulty was encountered after this change. Clearance was always allowed at the bottom of the die.

R. E. BRUCKNER.
Late Asst. Eng. U. S. N.

Dutch Scoop Wheels.

BY J. RICHARDS.

The Dutch are a thoughtful, stubborn people, and so long as coal and iron were not the master factors in the mechanic arts they had a first place in contriving one thing or another. They made compound marine engines, for one thing, long before anyone else; built ships, wonderful windmills and saw mills, but especially excelled in designing hydraulic apparatus.

The scoop-wheel was to them the most perfect machine for raising a large volume of water to moderate hights, and even to this day there are many people in Holland, Professor Huet among the number, who do not look with favor on centrifugal pumps and other new-fangled contrivances for this purpose.

Mechanical devices, like history, repeat themselves, and we find among the recently issued patents in this country one for a scoop-wheel (No. 609,655) that is a case in point. I have not taken the pains to examine the specifications, but the graphic portion will show that the old Dutch scoop-wheel is not dead yet, nor should it be, if the money is available to install and maintain a machine of such enormous dimensions.

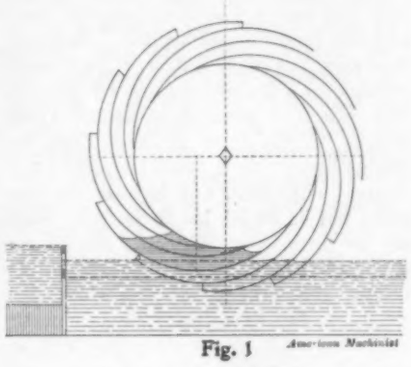


Fig. 1

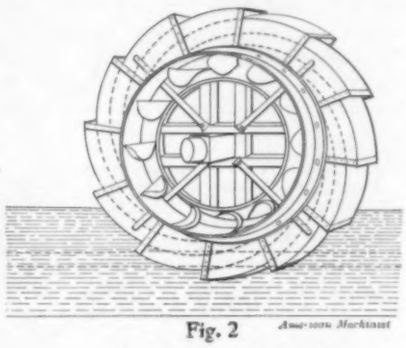


Fig. 2

AN OLD DUTCH SCOOP WHEEL.

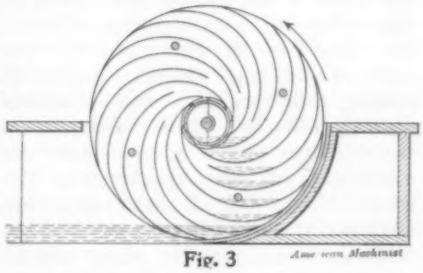


Fig. 3

SECTION OF RE-INVENTED SCOOP WHEEL.

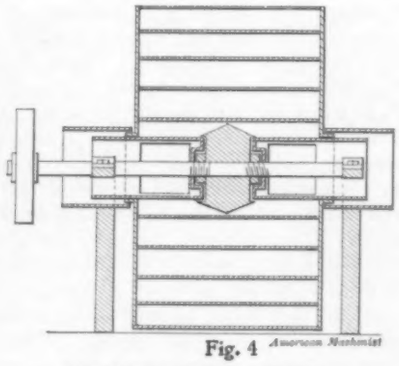


Fig. 4

RE-INVENTED SCOOP WHEEL.

To show the similarity of practice down through a period of 256 years I offer a drawing of a scoop-wheel patented in the Netherlands and in England in 1642 by Wheler & Crupley, British patent No. 127 of that year. Figs. 1 and 2 are taken from the old patent referred to, and Figs. 3 and 4 from the recent American patent above referred to.

Aside from the curiosity that attaches to this and other matters of the kind there is a lesson to be learned in the survival of such things, and in the present case there are some interesting features. If water is to be raised, as in land drainage, to which service these wheels are commonly applied, the principal resistances are the weight of the water, its friction against surfaces, and disturbance and change of its course. Without consuming space to follow out these things, there is still a question whether in a mechanical sense there has ever been devised a water raising machine that will give a greater efficiency than one of these wheels.

Its near relative, the screw of Archimedes, is at a disadvantage in various ways. It has more water friction, diagonal stress on the bearings, and is more intermittent in action. No piston pump, such as is employed for drainage, at least, is so efficient; but these are not the only points to be considered. A centrifugal pump that would cost a fifth of what one of these wheels will, or a tenth as much, if foundations are considered, will do as much work at an efficiency of 70 per cent., or more than that, if well designed; still there are places and cases where a scoop-wheel may be best, notwithstanding its venerable age.

In "Bozems and Polders," by Professor Huet, of Amsterdam, can be seen many interesting and curious examples of early Dutch practice. Many fine drawings of the same kind were exhibited at the Centennial Exhibition of 1876, at Philadelphia, but they attracted little attention at the time because we had plenty of land above the water level and little use for such machinery. In future the subject may have more interest. The drainage of fluvial and other submerged lands is even now an interest of great extent.

The Index for Our 1898 Volume.

Owing to the unavoidable delays in connection with the installation of our new printing plant, it has been impossible to print the annual index with the usual promptness. The many inquiries which we have already received for it, lead us to make this explanation and to say that it will be distributed at the earliest possible date, and that every reader will receive one.

Inquiry for Machinery.

Those who make, or may know of the makers of such machinery as is called for below, will oblige us by sending name and address, mentioning the number of the inquiry. We cannot forward catalogs. We have inquiry as follows:

90—For names of makers of machinery used in the manufacture of shoe laces.

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Equal Pay for Unequal Services.

We note in another column the resignation of Chief Engineer W. M. McFarland, of the Bureau of Engineering of the United States Navy, and the acceptance by him of a responsible position with the Westinghouse Company, of Pittsburgh. It is quite unnecessary to say that the Navy Department loses the services of a valuable officer. It loses services of precisely the kind and quality that it is not only most desirable but most imperative to retain, if our navy is to develop and to be held throughout to the highest efficiency. It loses, too, a man specially trained for precisely the work to be done, and one presumably worth more to the naval service than to any outside concern, or in any other line of business. The fact, however, remains that outside interests bid for the services of this man fourfold what our Government pays, and no one thinks that the Westinghouse Company is doing it with any expectation of losing money by the transaction.

It should not be possible for this thing to happen. If it should be certain anywhere in the world that a man would be paid what he was worth it should be in the service of the United States Government. The contrary is the notorious fact. The best men cannot afford to engage in public work. Men find more satisfactory and more remunerative positions in life by engaging in business for themselves, or by going into the employ of some of the large manufacturing or commercial corporations. The inadequacy of compensation is very general throughout all the higher positions of the Government service, and also in that of the several States and the larger municipalities. Governor Roosevelt has lately had the experience of looking for a $25,000 man for a $5,000 job. The office of Superintendent of Public Works of the State of New York has gone begging for a competent and trustworthy incumbent, not because the man could not be found, but because he would not be justified in sacrificing income and opportunity by accepting the position. Of course the securing of competent men must be the exception rather than the rule where it is so notorious that they are not to be paid what they are worth; and where the appliances for enforcing a thorough education are provided, as with the officers of our army and navy, the retaining of the output of the institutions which are justly the nation's pride is equally problematical.

The remedy suggests itself at once; but, when it is looked into, the self-suggesting remedy is not so easy of application nor so sure in its promise of all-around satisfaction. If men are not paid enough, why, pay them more, and pay them whatever is necessary to retain them. Easier said than done, and not at all because Uncle Sam is not rich enough. There is plenty of money, but where may we locate the discretion to discriminate? The trouble resides in the apparent necessity of ranging men in classes, and in paying them the class rate. It is the same with the engineers of the navy as with the machinists and other workmen in the general shop. Men are paid equally for services that differ widely in value. This injustice remains with the higher rate of remuneration as with the lower. A uniform and general advance of salaries or wages is no approach to equitable adjustment, and does not rightly distribute the rewards of excellence. There are, no doubt, differences in chief engineers. There are some that are all that could be desired in their places, who can be relied upon to maintain their machinery and their subordinates in high condition, and who will not be wanting in anything when the day of action comes, but who still are this and nothing more. They would be of little value out of their accepted life positions, and would be little likely to be subject to exterior enticements. Then there are others who are distinctly larger men, men who, it is safe to say, will be prolific of achievement in the greater world if they have the opportunity. The magnificent offers that come to those are measures of the market value of the individual, and not of the class to which the individual happens to belong. It is very desirable that the Government should be able to retain the services of its most excellent servants; but these are the ones which it is constantly most in danger of losing, and it must continue to be so until some genius arises who can show us a better mode of salary adjustment than any which has yet been devised.

The pay of the men in the shops also is far from equitable and satisfactory, and this not alone because the workman universally is underpaid, but especially because some are far more underpaid than others. Most superintendents and proprietors, if they know their men as they should, readily acknowledge that some of their best men are not paid what they are worth, but still they are practically powerless to adjust wages with perfect or even approximate equity. There may some day be a better way devised, but as yet it is not very clearly in sight.

The Merchants' Association of New York is making a vigorous effort in behalf of the bill now pending in Congress and which has been favorably reported by Mr. Adams, of the Committee on Foreign Affairs, and intended to increase the efficiency of the United States foreign service and provide for the re-organization of the consular service. The association has secured the co-operation of manufacturers and exporters throughout the country, and it is expected to make a strong showing in favor of the passage of the bill. All are practically agreed that some reform in this branch of our foreign service is urgently required.

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.

(7) L. A. C., Goshen, Ind., asks for particulars regarding the making of snap piston rings. A.—You will find an article on this subject in our issue for July 30, 1896, which gives a scale of dimensions for these rings and explains what we consider the best method of making them. The number in question is out of print and cannot be supplied.

(8) W. P., Independence. Mo., asks: (1) What is the method of calculating the pressure on the bearings of a rotary pump which consists of a pair of gears running together in an enclosing case? What portion of the gears sustain the load, or should the total projected area of the gears be considered subject to the pressure due to the head of water? A.—The pressure will be the product of the water pressure above the gears by their projected area. (2) What pressure per square inch will a 2½-inch cast-iron journal stand running 250 rotations per minute in a good babbitt bearing? A.—Allow 100 pounds per square inch of projected area.

(9) H. H. M., Mt. Carmel, Ill., asks: (1) What is considered about the best device for feeding gasoline to a gasoline engine? A.—For engines of moderate size a very satisfactory and simple method is to pump the gasoline through an overflow cup, from the base of which a short tube projects into a horizontal section of the air-supply pipe, terminating in an adjustable needle orifice a little above the normal level of the gasoline in the cup. The slight vacuum in the pipe will then suck in a spray of gasoline, which is self-regulating within fairly wide limits of speed. If necessary, the mouth of the pipe may be partially closed by a permanent obstruction. It is highly desirable that the gasoline be completely vaporized and commingled with the air before it enters the cylinder (or, if the engine be of the 2-cycle type, the crank-case); and to effect this a sufficient length of pipe, with or without baffles, must be interposed between the point of injection and the cylinder, or the air must be warmed by being drawn through an air-jacket around the exhaust pipe. To start the engine, a small quantity of free gasoline may be introduced into the air pipe. If the engine governs by throttling, it must throttle on both sides of the point of injection, to preserve the vacuum unchanged. (2) What degree of compression is usual in general practice? A.—There is no "usual" degree of compression, for the reason that this depends entirely on the size and type of the engine. A good basis is to make the clearance volume 45 per cent. of the net volume of the stroke, which gives roughly 70 pounds compression (absolute). This is about the limit for short stroke engines of 4 to 5 inches bore, and must be cut down for smaller ones. For larger bores or relatively longer strokes the compression may be somewhat increased; a clearance volume of 37 per cent., giving about 90 pounds, being permissible for 6 x 12 inches 4-cycle engine. It is not practicable to go much beyond this, except for dilute fuel gas, as it takes but little to ignite the charge spontaneously at this pressure. It is very necessary, when working with any but the lowest compressions, to design the sparker so that it cannot overheat; and in general it is impracticable to use as high a compression in 2-cycle as in 4-cycle engines, on account of the rapid heating of the sparker and other exposed parts.

A German inventor has recently patented in the United States a sand blast apparatus for bringing out the grain in wood for decorative purposes.

The twentieth annual meeting of the Engineers' Club of Philadelphia will be held Saturday, January 21, at the society's house, 1122 Girard street, Philadelphia, Pa.

Retirement of Chief Engineer W. M. McFarland.

Chief Engineer Walter M. McFarland, U. S. Navy, is to leave the Government service to become assistant general manager of the Westinghouse Company, at Pittsburgh. His resignation is to take place six months hence, but in the meantime he is granted six months' leave of absence. Mr. McFarland entered the Naval Academy in 1875 as the result of a competitive examination of students of the public schools of the District of Columbia. He became assistant engineer in 1881, passed assistant engineer in 1891, and recently was promoted to the rank of chief engineer, being one of the youngest officers in recent years to attain that grade. Mr. McFarland has been a very busy man. While attached to the Bureau of Engineering and first assistant to Chief Melville he has been until recently the compiler of the Journal of the American Society of Naval Engineers, and is also a prominent leader in the society of Naval Architects and Marine Engineers. He has been earnest and unceasing in his efforts in behalf of the naval personnel bill. He has contributed several excellent unsigned articles to our columns. He is to be congratulated in the fact that he goes to his new position at a salary four times as great as that received from the Government, and the niggardly policy which continually drives out the best men of the service has another exemplification.

Personal.

Mr. L. D. Warner, president of the Naugatuck (Conn.) Malleable Iron Company, recently resigned, and Mr. Harris Whittemore was chosen as his successor.

Mr. W. R. Sawyer, who for some time past has been foreman and later superintendent of the Cleveland Gear Works, has now leased that business from Mr. George B. Grant, and will conduct it on his own responsibility.

Ralph A. Gleason, lately employed as designer of special machinery for the Detrick & Harvey Machine Company, of Baltimore, Md., has gone to the Maryland Steel Company as assistant superintendent of the mechanical department.

Rafael De La Mora and Mora y Lopez De Lara, mechanical engineers of Guadalajara, Mexico, have formed a partnership under the firm name of Mora y Lopez de Lara to engage in the importation and installation of machinery in that country.

Mr. A. H. Tuechter, of the Bickford Drill & Tool Company, of Cincinnati, and Mr. Sherman C. Schauer, who has been superintendent of the Hamilton Machine Tool Company, have purchased the business of A. H. Kerkhoff & Co., of Cincinnati, and will build machine tools there under the name of the Cincinnati Machine Tool Company.

John Scott, superintendent of the Willimantic (Conn.) Linen Company, has resigned to retire from active business. Mr. Scott has been mechanical head of this company since 1877. He began life as a machinist in the Lawrence Machine Shops, Lawrence, Mass., went South and was connected with the North Carolina Central Railroad five years, coming North when the civil war began, and connecting himself with the Lowell Machine Shop, where he was in charge of the locomotive department for five years.

Obituary.

James A. Charnley died at Providence, R. I., January 8, sixty-seven years old. Mr. Charnley was a prominent tool maker. He first learned machine engraving, and later had charge of the mechanical department of the Providence Toy Company, subsequently becoming an independent manufacturer of jewelers' tools and supplies. He was an expert steel worker, and especially an adept at figure and letter cutting. He accomplished a very close imitation of hand chasing by the use of finely cut rolls and press dies. He developed several new ideas in photography, and produced a print with a peculiar finish by interposing tissue paper between negative and glass, and also used ground glass and other media with novel results.

Milan C. Bullock, President of the M. C. Bullock Manufacturing Company, died in Chicago, January 12, sixty-one years old. Mr. Bullock was born in Granville, N. Y., grew up on a farm and was first apprenticed to a miller. He enlisted at the beginning of the civil war, but was rejected on account of asthma, from which he suffered most of his life. He apprenticed himself as a machinist at twenty-four years of age, and then ranged from shop to shop from Massachusetts to Missouri, getting a wide knowledge of machine shop practice. He soon, however, became specially interested in mining and quarrying machinery. In 1866 he entered the employ of the Stone Cutter Company, Rutland, Vt., and two years later he was with the Windsor Armory Company, Windsor, Vt., who were then building diamond drills and channeling machinery. In 1870 he was superintendent of the Pennsylvania Diamond Drill Company, patented a number of important improvements in diamond drills and developed and widely extended the use of the drill. In 1871 Mr. Bullock became general superintendent of the American Diamond Drill Company, of New York, and introduced the diamond drill in the operations at Hell Gate with great success. In 1874 the company failed, also ruining Mr. Bullock financially. After organizing another company unsatisfactory developments led him to resign, and he then went to Chicago, engaging in business on his own account in 1875 with a capital of $600. In 1878 the present M. C. Bullock Manufac

turing Company was inaugurated and the growth of the business has since been rapid and continuous, and it has now a world-wide reputation. Mr. Bullock was a man of noble presence and of most genial ways. He commanded the high respect of all whom he met, and the deep affection of those who knew him. His death is a loss of unusual magnitude to both the mechanical and the business world.

Motocycle Purchases by the Count de Jotemps for the European Markets.

The event of most commercial importance in the history of the American motocycle industry so far, is the reported purchase by the Count de Jotemps, of Paris, of a great number of mechanically-driven carriages from The Fischer Equipment Company, Chicago, builders of electrically-driven vehicles; from the Stanley Company, of Newton, Mass., steam wagons; and from the Overman Company, of Chicopee Falls, Mass., and the Holyoke (Mass.) Motor Works, the Overman and Holyoke Wagons being driven by explosion motors. The original announcement was to the effect that Count de Jotemps had ordered a great number of vehicles from each of these concerns, and had made very large cash advances on these orders, and that the Count was at the head of a strong syndicate, including Albert Geiger, of Boston, organized to monopolize the sale of American motocycles in Paris, London and Berlin.

In regard to this statement the Fischer Company writes as follows:

"We have your letter of December 31, and beg to say that the clipping from the newspaper is correct in its every essential feature so far as we are concerned."

The Stanley Company say:

"The article which you enclosed is true so far as we are concerned."

In reply to a request for more definite information the Stanley Company say, date Jan. 10, 1899: "We cannot at present give you the particulars of our contract with the Count."

The Overman Company declines giving information.

The Holyoke Motor Works say, under date of Jan. 7, 1899:

"In reply to your inquiry of December 31, we beg to state that Vicomte de Jotemps, representing a French and American syndicate, has contracted with us for 50 motor vehicles of different designs to be delivered during the season of 1899. The prices average about $14,000 [?] The first lot of carriages is to be ready for shipment not later than March 15. . . . We are at present making three styles, a runabout, a physician's carriage, and a park phaeton . . . weighing approximately 900, 1,000 and 1,200 pounds, respectively. Speed varies from 2 to 20 miles per hour on good roads, taking a grade of 20 per cent with ease; prices, $1,000, $1,100 and $1,500."

Albert Geiger writes this January 2, 1899:

"The paragraph from the 'Sun' is not correct, inasmuch as I am not yet a stockholder in any company handling automobiles. It is, however, quite possible that I may take an interest in this business. I leave for Europe to-morrow to determine this proposition."

The Fischer Equipment Company's catalog shows twenty different styles of storage battery driven wagons, and this concern is said to be able to turn out wagons rapidly.

The Overman Company has very large works, and can produce motocycles in any desired quantities. Mr. Overman went on record in an interview as believing in the possibility of very low priced gas engine driven wagons, from $450 to $500 each. In November last Mr. Overman said the company had three trial vehicles on the road, but refused to permit them to be seen, or to give detailed information.

The Holyoke Works has not, at this time, a large plant of its own, but can undoubtedly produce work in short order, as Holyoke is contiguous to unlimited production facilities. The Stanley Company has an abundance of capital, and the Mason Regulator Company are building the Stanley wagon engines, so that any number of Stanley steam wagons can be produced as fast as ordered.

The truth about the Count de Jotemps' orders appears to be that he has placed positive orders for the immediate delivery of a large number of American-built motocycles, and that we are to begin to supply the European demand for automobiles before we make very much use of them at home, because of the reputation enjoyed abroad by American machinery of all kinds. Without question, small as has been the actual use of the motocycle in the United States, we have better mechanically-driven wagons here than anything produced elsewhere, all of which is very flatteringly confirmed by the Count de Jotemps' purchases.

HUGH DOLNAR.

We mentioned lately the trial of Dr. Gatling's 8-inch cast steel gun at Sandy Hook. It is worth while to note in connection with that event, as a sample of cheek as a substitute for enterprise, that on December 16 one of the notorious "yellow" publications of this city gave a cut of the Sims-Dudley pneumatic gun, with the companion picture of the twin breach-loading mechanism, as shown in our columns several months ago, as a correct representation of Dr. Gatling's gun.

Many Americans will now be wanting definite and accurate information about Cuba, especially from its business side, and to all such Americans the book called "Commercial Cuba," by William J. Clark, must prove invaluable. It is a book of over 500 pages, with 8 maps, 7 plans and 40 full-page illustrations. It tells practically all about Cuba, and is a thoroughly good and useful book for all who may be interested in the island, and may wish for information regarding it. At the back is a commercial directory of the island, and all the work performed in the preparation of the book has evidently been very conscientiously and intelligently done. It is published by Chas. Scribner's Sons, New York. Price, $4.

The third annual convention of the American Foundrymen's Association will be held at Pittsburgh, Pa., on Tuesday, Wednesday and Thursday, May 16, 17 and 18.

Commercial Review.

NEW YORK, SATURDAY,
January 14, 1899.

DYNAMOS AND MOTORS.

At the end of the second week of the new year the feeling of satisfaction prevalent among electrical selling interests indicates that there is little wanting to perfection of trade. The relation of the volume of business for 1898 to that of 1897 is remarkably different in different cases. It may be somewhat a surprise to learn that with more than one company 1897 was the better year. Yet upon an average the trade of 1898 must be far the greater. The report of the General Electric Company for last year is not yet given out, but toward the close of the season sales indicated a total of $18,000,000 as against $12,000,000 for the year previous. For this, supplies were largely accountable. The known activity of the Westinghouse Company would seem to denote a large increase in its case also. The contracts of the Crocker-Wheeler Company, taken as another example, showed in this territory an increase of some 60 per cent. The capacity of its plant has been greatly enlarged within a year past. Speaking of new plants, it is said that the hull of the steamship "Kaiser Wilhelm der Grosse" could be placed under the central arch of the General Electric Company's new machine shop at Schenectady and the doors closed.

The electrical business of 1899 thus far has been almost uniformly good, with an amount of work in sight which offers every indication of continued activity as the year progresses. The factory power transmission line is notably good. A great deal of electrical machinery for industrial works is likely to be purchased this season.

Several steamship companies have taken

it into their heads, simultaneously, or borrowed the idea one from another, to install in their New York piers electrical plants for lighting and for operating hoists, although upon the latter purpose they are not all decided. The White Star, Mallory, Cunard, and Wilson lines are among those which are installing plants or expect to do so. A Crocker-Wheeler generating plant will be installed for the White Star Line; the General Electric Company is attending to the Mallory; and for the Cunard line, whose electrical machinery contract is not yet awarded, R. P. & J. H. Staats are the contractors, and and Osterberg & Sutton consulting engineers. The Wilson and Cunard lines may have a plant in common.

Several important water power transmission contracts in this country are on foot or recently completed. The General Electric Company has closed a contract to furnish machinery for utilizing 3,000 horse-power at the St. Anthony Falls, near Minneapolis, Minn., in addition to the 7,000 horse-power previously installed. The entire water power of the lower dam will now be utilized. The new power will be used by factories in the vicinity of the falls. Besides generators, transformers for transforming the current to be transmitted, and rotary converters are included in the apparatus contracted for.

The Potomac Electric Power Company has placed an order with the General Electric Company for railway generators, etc., to the value of about $50,000.

There is an inquiry in the market for a 60-light alternator with all supplies except poles, to go to the West Indies. An encouraging number of water-power transmission contracts are looming up in various parts of Spanish-America; for instance, Venezuela.

The Northern Electric Company is now installing in the silk mill of C. Stohn's Sons, Jersey City, N. J., a power-transmission equipment consisting of 200 horse-power in generators, and about the same in motors.

An electrical plant has just been started in the hat factory of F. Berg & Co., Orange Valley, N. J. The electrical machinery is Crocker-Wheeler, and includes two generators, aggregating 200 horse-power, with about 50 horse-power in motors. The portion of the current not used for power will be employed for heating operations. Mr. W. S. Hadaway, Jr., as engineer, has devised for the plant a very economical heating system by which the exhaust steam will be used for low temperature heating, but the heat from the current, instead of gas, as usual, will be employed for the high.

A water-power transmission system of the Stanley Electric Manufacturing Company is just being started up in Canada to convey 20,000 horse-power developed from the Richelieu River to Montreal, a distance of 16 miles, the current to be used for general purposes. Two months ago a 2,500 horse-power 10 mile water-power transmission plant of this make was put in operation to supply the city of Hamilton, Ont. The Stanley people have been having considerable business in regard to water-power transmission systems for mining on the Pacific Coast.

The foreign department of the General Electric Company in New York has been reorganized. Mr. W. J. Clark, of the railway department, succeeding to general management of the foreign department. Mr. D. Mazanet, who has held that office for five years, becomes managing director of the Mexican General Electric Company. with headquarters in the City of Mexico.

LETTERS FROM THE TRADE.

From the Nicholson File Company, Providence, R. I.: "The past year has brought to us a satisfactory volume of trade. Prices are now so low that volume of product is an all-important factor, and this must be accompanied by wise economies in every department and process of manufacture. Our export business has witnessed a healthy and satisfactory growth during the past year. As to our prospects for the year to come—the country evidently feels better than for a long time past—indications certainly point to a better state of trade. We hope and believe that the coming year will be one of marked prosperity, and that we shall realize our share of it."

From the Norton Emery Wheel Company, Worcester, Mass.: "Our export trade has increased somewhat during the past year, although not to the same extent as our home trade, which is far in excess of any previous year, and we are pleased to say that the prospects seem very bright for a good business the coming year in all directions. We are employing a larger force than ever before, about 200, and our orders appear to come from all lines of industry." In addition to this general report from the company we learn that its business in this territory has shown excellent improvement and is very encouraging.

From the Cleveland Gear Works, Cleveland, O.: "Improvement in the manufacturing lines for the last six months is marked, as manifested not only by inquiries, but by the actual placement of orders. Prices are fairly satisfactory, though competition is brisk. We have increased our working force by one-quarter, and look forward with expectancy to increasingly better business in the year and years before us."

Messrs. Charles H. Besly & Co., 10 and 12 North Canal street, Chicago, Ill., U. S. A., manufacturers and dealers in machinists' hardware, report a very successful business for the year 1898 just closed, a decided improvement being noted in the demand for the specialties of their own manufacture, viz., taps of every description, Badger & Gardner die stocks, Helmet sheet bronze and wire for springs, parallel clamps, Perfection and Bonanza oil cups, and Gardner grinders, their Helmet solid oil, and Mannocitin, a rust preventive. Among foreign orders for above material may be noted shipments to England, Russia, France and India, Brazil, the Argentines, Uruguay, Chili, Peru, Bolivia, as well as large shipments to the jobbers and manufacturers in this country. Their factory at Beloit, Wis., is being run full time, and they regard the outlook for the future very bright.

CHICAGO MACHINERY MARKET.

Engine and boiler makers in the West are a cheerful class of manufacturers. One of them remarks that he is paying no attention to small inquiries, say for 100 or 200 horse-power, for the reason that it takes about as long to close a contract for an outfit of that size as one of from 1,000 to 2,000 or more horse-power, and he has as many inquiries of the latter kind as he can attend to or as his plant, running night and day, can turn out. Still, the small buyer is not wholly neglected, for there are other makers of a less average size of product, who are looking after the modest deals that are current. The drift of trade is steadily towards the larger power and this accounts for the greater contentment of the large seller. The new year has opened in a manner most gratifying to the trade. One manufacturer, who keeps a close tab on the prospective chances for business, says there are now in the market here 50 per cent. more inquiries than a month ago.

It is a general broadening of trade so liberal in bounds as to be almost heterodox. There is a marked turn of affairs towards the development of industries that might be classed as luxuries for a people, schooled to rigid economy. Thus, one of the present features of power expansion is in ice and refrigeration plants at many of the smaller towns and cities throughout the West. Inquiries for that class of work are becoming very common.

A revolution seems to be under way among the lumber interests of the Northwest. The lumber men are discarding slide valve for Corliss engines, picking up all the second-hand engines they can find, but also buying quite freely from factory. They are discarding refuse lumber as a fuel and substituting coal, finding the latter the more economical, even in remote districts, for the lumberman can now utilize almost the entire product of his mills commercially. The engine builder profits by the change. Iron working plants also are keen for new power. Municipal work is thriving and electric plant trade is often expressed by the trade here as "out of sight."

There is a disposition among the engine builders to advance prices, but it is not general. Boiler makers, however, have in a majority of instances advanced

prices about 7½ per cent. on account of the advance in plates and tubes.

Among recent sales here may be noted the following: E. P. Allis Company, one horizontal cross compound direct connecting engine to an 800-kilowatt generator for a Grand Rapids (Mich.) street railway company, and one vertical cross compound to a 1,000-kilowatt generator for a Toledo street railway company; Erie Iron Works, 300 horse-power water tube boiler for a municipal plant at Sturgis, Mich.; C. P. Willard & Co., water tube boiler for a British-America port; The Babcock & Wilcox Company, 1,600 horse-power boilers for the Chicago Alley Elevated road, and 1,800 horse-power boilers for the Chicago Metropolitan Elevated road; Wickes Bros., 450 horse-power tubular boilers for a lumber plant at Pentwater, Mich., and 600 horse-power vertical water-tube boilers, Traverse City, Mich. The Bethlehem Iron

(*Continued on page 55.*)

Wants.

Situations and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisement under two lines accepted, and no advertisement abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Technical mechanical draftsman, 4 years' experience. Box 28, AMERICAN MACHINIST.

Foundry foreman wishes position; experienced, heavy or medium castings. Box 37, AMERICAN MACHINIST.

Tool diemaker on fine, accu. work; A1 on experim. work; mfg. concern pref. Box 35 AMERICAN MACHINIST.

An experienced foreman on engines and general machine shop work desires position. Address Box 30, AMERICAN MACHINIST.

Toolmaker, up-to-date mach. tools, speaking three languages, wishes to represent firm, Europe. Box 34, AMERICAN MACHINIST.

Wanted—Position by mech. draftsman, exp. in stat. engine construction and designing; good references. Box 32, AMER. MACHINIST.

Competent mechanical draftsman and designer wants to make a change; no objection to small town. Address Box 27, AMER. MACH.

Draftsman and mechanical engineer, 20 years' varied exp., prac. designer of high-grade engines, tools, etc., desires situation. Box 29, AMERICAN MACHINIST.

A Jones & Lamson flat turret lathe hand wishes to make change; desires steady position; is a hustler; is competent to take charge. Box 3, AMERICAN MACHINIST.

Designer and supt. for small concern manufacturing semi-automatic machinery wants change in February, same line, moderate salary; willing to go anywhere, but small town preferred. Box 33, AMERICAN MACHINIST.

Help Wanted.

Wanted—Six first-class machinists. Address The F. M. Davis Iron Works Co., Denver, Col. Wages $3 per day.

General draftsman wanted to work on Staten Island; please give previous experience, references and salary required. Address R. D. W., Box 831, West New Brighton, N. Y.

Wanted—Three first-class, all-round machine blacksmiths and tool dressers; skillful men of good habits can have steady work. Address in own writing, giving references, experience and wages expected, Atlanta Machine Works, Atlanta, Ga.

Apprentices.—A few additional apprentices, 16 to 17 years of age, will be received by R. Hoe & Co., printing press manufacturers, to learn the machinist's trade in its various branches; attendance at the firm's evening school three evenings each week is expected. Apply personally or by letter, R. Hoe & Co., 504 Grand st., New York.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear wheels, gear cutting, Grant; see p. 32.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

The finest punches and dies; send for samples. Waltham Mach. Works. Waltham, Mass.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N.J.

Book "Dies and Diemaking," price $1, post paid. J.L.Lucas,Prov.R.I. Send for index sheet.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., New York.

For Sale—Iron planing machine, to plane 48 inch by 42 inch by 24 feet; two heads on cross-rail; made by Gleason Tool Co., of Rochester. Apply to The Holly Manfg. Co., Lockport, N. Y.

Two mechanics with long experience in the machine-tool business have designed a line of vertical spindle milling machines superior to anything as yet on the market; would like to interest some capitalist in their manufacture. Address Box 31, AMERICAN MACHINIST.

Institutions retiring from business having machine tools, brass or wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

For Sale or Rent.—Foundry and machine shop with additional land, in good condition and well equipped for medium heavy work: capacity of foundry 7 tons per day; located on railroad within eight miles of New York; terms easy. Call or address J. F. Sweasy, 26 Nassau street, New York.

Complete set American Machinists, 1877 to 1898, for sale; first 18 vols. bound in morocco, uniform in style (binding alone cost $4.75 per vol.); 1896 vol. 19 in cloth; 1897 vol. 20 includes advertising, and is in leather; 19 volumes have name of private individual on side; will sell the twenty volumes complete for $100. Address Volumes, care AMERICAN MACHINIST.

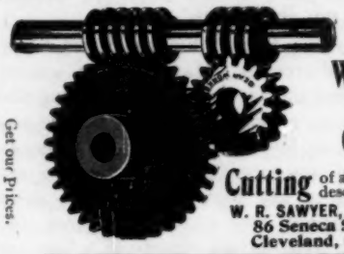
STATE OF NEW YORK,

CIVIL SERVICE EXAMINATIONS.

The open competitive merit examination advertised for January 14 for the position of Director of Trade Schools at the Elmira Reformatory has been postponed till January 27 and 28 and opened to non-residents of New York State. Salary $100 per month and room free.

There will also be held on February 4 at various places throughout the State, examinations for Assistant Manual Training Instructor at the Elmira Reformatory and the Rochester Industrial School and for Assistant Carpentry Instructor at the latter institution.

Intending competitors must file applications with this Commission at least 5 days before the date of examination. For further information and application blank, address Secretary New York Civil Service Commission, Albany, N. Y.



Gear Wheels and Gear Cutting of all descriptions.

Get our Prices.

W. R. SAWYER, Lessee, 86 Seneca Street, Cleveland, Ohio.

CLEVELAND GEAR WORKS.

For Sale Cheap.

Fourteen one-eighth inch Adt riveters used two seasons, *fine* condition.

Vonnegut Hardware Co., Indianapolis, Ind.

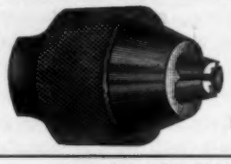
THE WARDEN OIL FILTER

is guaranteed to reduce your oil bills at least 50%. Ask your supply house or oil company to send you one on trial. Used by prominent firms throughout the world.

Business Established 9 Years.

THE BURT MFG. CO. AKRON, OHIO, U. S. A.

Largest Manufacturers of Oil Filters in the World.



Almond Drill Chuck.

Sold at all Machinists' Supply Stores.

T. R. Almond, 83 & 85 Washington St., Brooklyn, N. Y.

76,800 DAILY PRODUCTION

5 FACTORIES

5 BRANDS

NICHOLSON FILES.

16 Governments

85% R.R., 70% U.S. Contracts

70% of Total Production of America

FOR SALE ALL OVER THE WORLD.

NICHOLSON FILE CO., Providence, R. I., U. S. A.

NEVER SUCH A BARGAIN.

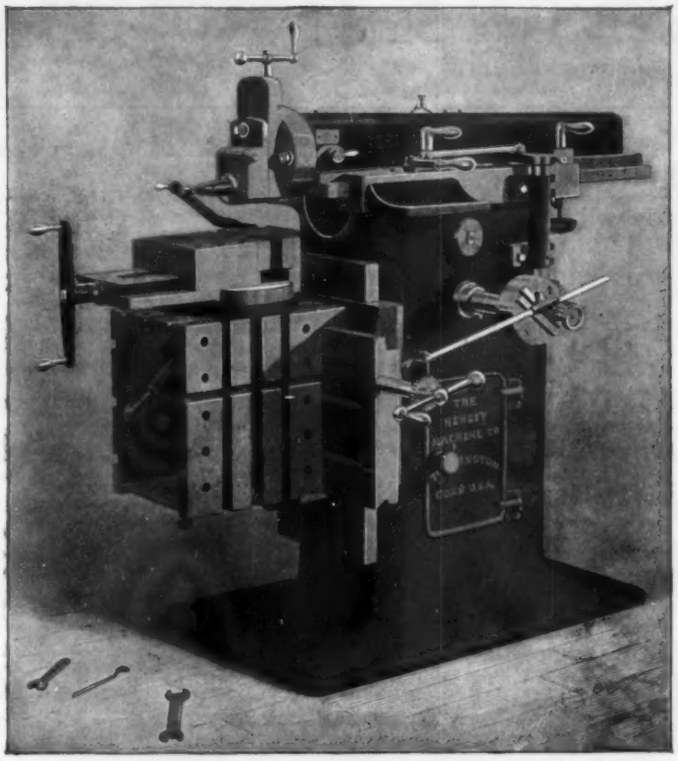
This Screw Plate with 5 Round Dies, 5 Taps, Die Holder in Wooden Case,

List, $4.50. Our Price, $2.75. Postage, 25c.

Send stamp for list 834, showing how you can save up to 50 per cent. on all the tools you use.

THE FRASSE CO., 17 Warren Street, New York.

NEAR BROADWAY.



24 inch Pillar Shaper.

These shapers have a positive locking friction, and are guaranteed to work accurately to a line.

Stroke quickly adjusted to any position with ram in motion. Then it can be varied in the smallest degree with our micrometer adjustment stop. Shapers have quick return, also two cutting speeds.

The Hendey Machine Company,

TORRINGTON, CONN.

Agents for the Pacific Coast: Pacific Tool and Supply Company, San Francisco., Cal.
J. W. Cregar, Philadelphia Bourse Exhibition.

EUROPEAN AGENTS:
Schuchardt & Schutte, Berlin, Vienna, Brussels; Chas. Churchill & Co., Ltd., London and Birmingham, England; Adolphe Janssens, Paris, France.

(*Continued from page 54.*)

Works have taken ten orders at Chicago since January 1, including one for large hollow forge nickel steel shafts for mining machinery.

CINCINNATI REPORT.

Cincinnati manufacturers of machinery, machine tools, and electrical supplies who gave attention to export trade last year were liberally rewarded for their trouble. Home trade also, in practically all cases, showed an improvement over the preceding year. The increases for 1897 as compared with 1898 range from 25 per cent. upward, even to a doubling in volume. Some brief reports from leading manufacturers of machine tools and other machinery may serve to show how matters in Cincinnati stand.

The Cincinnati Milling Machine Company handled an increased amount of trade last year, probably the most in its history. Home demand was improved and the export field showed the result of the cultivation that had been bestowed upon it in 1897 by personal effort in Europe.

The 1898 trade of the G. A. Gray Company also was probably the largest in its experience. They have been kept busy from month to month, and have now on hand contracts sufficient to furnish employment to their workmen for several months to come. With the increased facilities given them by their new plant they expect this year to cope with a business still larger.

The Lodge & Shipley Machine Tool Company has had a growing business, generally, since the year of its formation, and 1898 was far ahead of any year previous. They attribute their success largely to their efforts in bringing out improved styles of machine tools. In three or four months they hope to be fully installed in the large new plant they are now erecting.

The Bradford Mill Company, which is one of the older machine tool companies of Cincinnati, was favored in 1898 with an increase over 1897, estimated at some 50 per cent. Exports showed growth, and domestic trade also a healthy expansion. They have been keeping from 100 to 200 men employed, and at times have had to run their works extra hours.

Dietz, Schumacher & Boye have experienced a growing business from year to year, but the trade of 1898 was about double that of the year before it. Orders seemed to be about equally divided between domestic and foreign.

The Bickford Drill & Tool Company's trade for 1898 was the best in its history. It exceeded that of 1897 by upward of 25 per cent. It was most notable in the latter six months of the year. Domestic trade constituted slightly more than one-half of the total business. The company enlarged its facilities during the year.

The American Tool Works Company reports quite a large increase for 1898.

Many good-sized orders came from centers of trade in foreign countries where agencies had been established.

Dreses, Mueller & Co. were among the most fortunate of the tool builders in regard to business improvement in 1898, which amounted to between 50 and 100 per cent. The greater bulk of the orders was foreign. The company made improvements in its plant during the year which increased its room and which have put the concern in excellent shape for the future.

The Cincinnati Shaper Company, started a few months ago, has been putting motive power and a line of machine tools of improved patterns in the building where it has become located, and expects ere long to be fully prepared to cope with orders.

The J. A. Fay & Egan Company found the business that ruled during the last half of 1898 better than for several years past. The improvement was particularly in home trade. To meet the demand from new establishments which started up to manufacture various kinds of woodwork they placed upon the market some improved types of machinery. They had occasion to increase their force of men.

The Lane & Bodley Company looks upon 1898 as a year of prosperity. With the bringing out of a new engine in 1893 they have been experiencing a growing demand for it in sizes up to 1,000 and over horse-power. Home trade has increased from all parts of the country, but a good share of the business has come from the South. A good amount of export trade also was received.

The Laidlaw-Dunn-Gordon Company's trade for 1808 was the largest for several years and almost double that of 1897. There were many orders for large waterworks' pumps, besides heavy sales of small ones for various purposes, some coming from points to which shipments had not previously been made.

Quotations.

NEW YORK, Monday, Jan. 16.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$12 00 @ 12 75
No. 2 foundry, Northern	11 50 @ 12 25
No. 2 plain, Northern	11 00 @ 11 50
Gray forge, Northern	10 50 @ 10 75
No. 1 foundry, Southern	11 75 @ 12 00
No. 2 foundry, Southern	11 50 @ 11 75
No. 3 foundry, Southern	11 00 @ 11 25
No. 1 soft, Southern	11 75 @ 12 00
No. 2 soft, Southern	11 50 @ 11 75
Foundry, forge, Southern	10 50 @ 10 75

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.09 @ 1.12½c.; refined, 1.15 @ 1.25c. Store prices: Common, 1.35 @ 1.40c.; refined, 1.40 @ 1.50c.

Tool Steel—Base Sizes—Standard quality, 6 @ 7c., with lower prices on some brands; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—Ordinary brands, from store, in small lots, 1.45 @ 1.55c.

Cold Rolled Steel Shafting—Base sizes, from store in small lots, 2.15c. upward.

Copper—Carload lots, Lake Superior ingot, 14¼ @ 14½c.

Pig Lead—Carload lots, 4.17½ @ 4.20c., f. o. b. New York.

Pig Tin—For 5 and 10 ton lots, 22 @ 22¼c.

Spelter—In carload lots, 5.35 @ 5.37½c., New York delivery.

Antimony—In cask lots, 8.65 @ 9.50c., according to brand.

Lard Oil—Prime city, present make, 46 @ 48c., in wholesale lots.

Our Annealed Die and Tool Steel
Saves Time, Labor, Money.

Crescent Steel Company,
Pittsburgh, Pa.
Chicago, Ill.
New York, N. Y.
Denver, Col.

We Claim the Following Merits for ..... Jenkins Bros.' Valves.

1. Manufactured of the best Steam Metal.
2. No regrinding, therefore not constantly wearing out the Seat of the Valves.
3. Contains JENKINS DISC, which is suitable for all Pressures of Steam, Oil and Acids.
4. The Easiest Repaired, and all parts Interchangeable.
5. Every Valve Tested before leaving the factory.
6. ALL GENUINE stamped with Trade Mark.

Jenkins Brothers, New York, Philadelphia, Chicago, Boston.

WE WILL DOUBLE YOUR WAGES if you will devote some of your spare time at home to study at a cost so small that you will not feel the outlay. Thorough and practical courses by mail in MECHANICAL AND STEAM ENGINEERING, MECHANICAL DRAWING, MACHINE DESIGN. BEST TEXT BOOKS FREE. Write for free circular T, sample pages of text books, drawing plate and booklet of letters from students all over the world.

THE UNITED CORRESPONDENCE SCHOOLS, 156 Fifth Ave., New York.

Press-Working of Metals.

A treatise upon the principles and practice of shaping metals in dies by the action of presses, together with a description of the construction of such implements in their various forms, and of the materials worked in them. By Oberlin Smith. Illustrated with 433 engravings. 276 pages. 8vo. Cloth, $3.00.

JOHN WILEY & SONS, 53 East 10th St., New York City.

Up to Date.

A New Forming and Screw Machine.

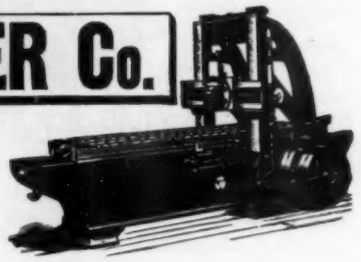
VERY ACCURATE. VERY RAPID.

Cutting from bar, work so slender that it is impossible to do it by any known method. Turns balls, ball cranks, knurls, tapers and does all kinds screw machine work. Is made as an attachment to turret or engine lathe or completely automatic. Capacity from 1-16 inch diameter to any size required. Write for particulars to

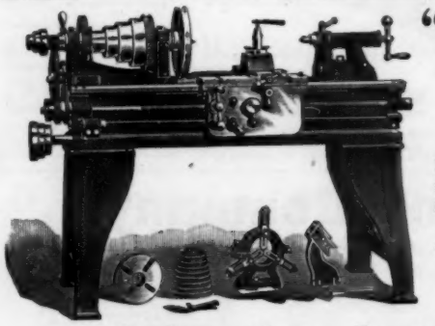
JAS. D. MATTISON, Dexter, Maine.

POWELL PLANER Co.

WORCESTER, MASS.



AGENTS:
U. Baird Machinery Co., 125 Water St., Pittsburgh, Pa.
J. A. Fay & Egan Co., 26 South Canal St., Chicago, Ill.
Robinson & Cary Co., St. Paul, Minn.
W. R. Colcord Mchy. Co., 502 North 2d St., St. Louis, Mo.
Parke & Lacy Co., Fremont St., San Francisco, Cal.
The Fairbanks Co., 705 Arch St., Philadelphia, Pa.



"Sebastian" Lathes

(13 and 15 inch swing).

Beds Any Length Desired.

High grade, modern lathes at a low price. Each lathe is provided with both screw and rod feeds, as well as power cross feed. Gears to cut all standard threads from 5 to 36 are furnished.

Workmanship, material and design are of the highest order.

You can't find anything better.

We also make a specialty of Screw Cutting Foot Lathes.

Sebastian Lathe Company,
117 & 119 Culvert St., Cincinnati, Ohio.

AGENTS.—Selig, Sonnenthal & Co., London, Eng.; Jn. Tragardhoh & Co., Goteborg, Sweden. E. Sonnenthal, Jr., Berlin, Germany; R. S. Stokvis & Zonen, Rotterdam, Holland.